



(51) International Patent Classification:

A61K 31/407 (2006.01) A61P 7/06 (2006.01)
A61K 31/436 (2006.01) C07D 487/04 (2006.01)

(21) International Application Number:

PCT/US2020/051645

(22) International Filing Date:

18 September 2020 (18.09.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

16/576,360	19 September 2019 (19.09.2019)	US
US2019/052024	19 September 2019 (19.09.2019)	US
62/902,887	19 September 2019 (19.09.2019)	US
16/576,720	19 September 2019 (19.09.2019)	US
62/906,437	26 September 2019 (26.09.2019)	US
63/024,441	13 May 2020 (13.05.2020)	US
63/024,432	13 May 2020 (13.05.2020)	US
62/704,785	28 May 2020 (28.05.2020)	US
62/705,106	11 June 2020 (11.06.2020)	US

(71) Applicant: **FORMA THERAPEUTICS, INC.** [US/US];
500 Arsenal Street, Suite 100, Watertown, MA 02472 (US).

(72) Inventors: **LUKE, George, P.**; c/o Forma Therapeutics, Inc., 500 Arsenal Street, Suite 100, Watertown, MA 02472 (US). **BABU, Suresh**; c/o Forma Therapeutics, Inc., 500 Arsenal Street, Suite 100, Watertown, MA 02472 (US).

(74) Agent: **NEY, Joshua, E.** et al.; Barnes & Thornburg LLP, 24 Frank Lloyd Wright Drive, Suite A-3300, Ann Arbor, MI 48105-9484 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

(54) Title: PYRUVATE KINASE R (PKR) ACTIVATING COMPOSITIONS

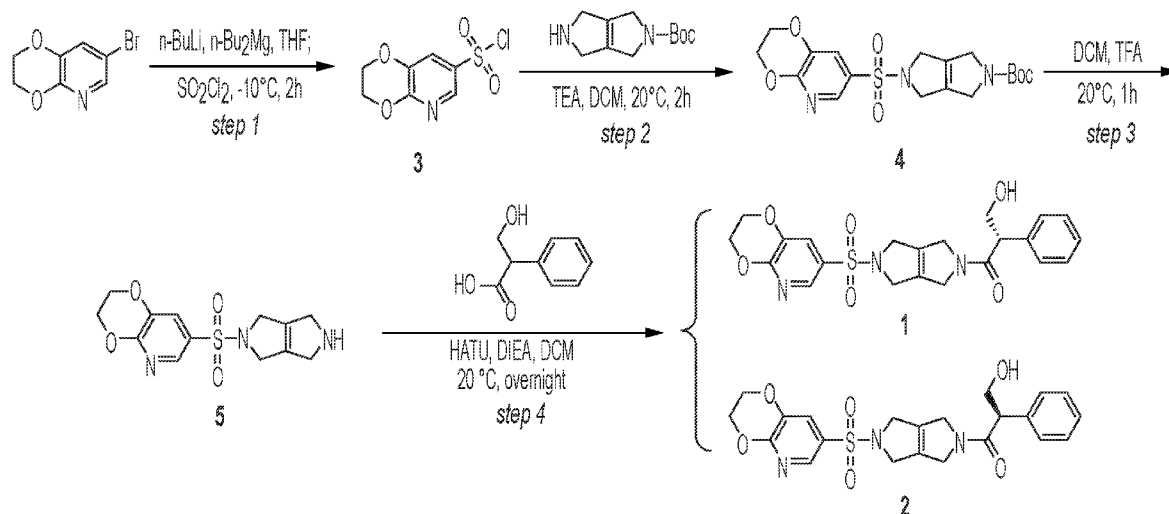


Figure 1

(57) Abstract: The present disclosure provides crystalline solid forms, spray-dried dispersions and pharmaceutical compositions, including solid oral dosage forms, of (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one ("Compound 1"), and preparation methods thereof.



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

PYRUVATE KINASE R (PKR) ACTIVATING COMPOSITIONS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of and priority to U.S. Patent Application No. 16/576,720, filed September 19, 2019; U.S. Patent Application No. 16/576,360, filed September 19, 2019; U.S. Patent Application No. 62/902,887, filed September 19, 2019; U.S. Patent Application No. 62/906,437, filed September 26, 2019; International Application No. PCT/US2019/052024, filed September 19, 2019; U.S. Patent Application No. 63/024,432, filed May 13, 2020; U.S. Patent Application No. 63/024,441, filed May 13, 2020; U.S. Patent Application No. 62/704,785, filed May 28, 2020; and U.S. Patent Application No. 62/705,106, filed June 11, 2020; each of which is incorporated by reference in its entirety.

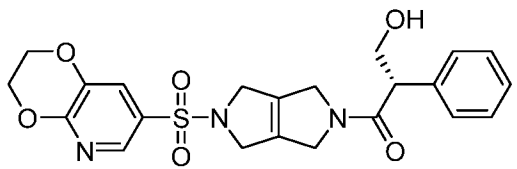
TECHNICAL FIELD

[0002] The present disclosure is directed to solid forms, dispersions and pharmaceutical compositions of a pyruvate kinase R (PKR) activating compound. More specifically, the present disclosure is directed to crystalline solid forms, spray-dried dispersions and pharmaceutical compositions of (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one, and preparation methods thereof.

BACKGROUND

[0003] Chemical compounds can form one or more different pharmaceutically acceptable solid forms, including amorphous and crystalline forms. Amorphous solid forms include dispersions, such as spray-dried dispersions, of amorphous and crystalline chemical compounds. Individual solid forms of bioactive chemical compounds can have different properties. There is a need for the identification and selection of appropriate solid forms of bioactive chemical compounds (including appropriate crystalline forms, where applicable) for the development of pharmaceutically acceptable dosage forms for the treatment of various diseases or conditions.

[0004] The compound (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one ("Compound 1"),



is a small molecule PKR activator which modulates pyruvate kinase activity. Compound **1** is described in International Publication No. WO 2018/175474 as one of many compounds suitable as small molecule modulators of pyruvate kinase activity. There remains a need for identifying solid forms of Compound **1** useful for various therapeutic applications.

SUMMARY

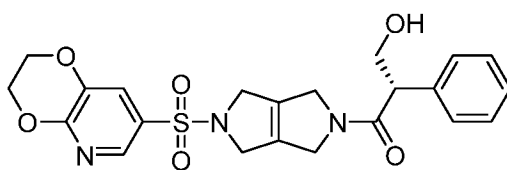
[0005] One aspect of the disclosure relates to solid oral dosage forms comprising a stabilized amorphous pharmaceutical composition of the compound (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one (also referred to as “stabilized amorphous Compound **1**”). As used herein, the term “stabilized amorphous Compound **1**” refers to an amorphous solid form of Compound **1** that is stabilized (e.g., by combination with certain stabilizing polymers and/or other manufacturing processes) to prevent the formation of crystalline forms of Compound **1** or solid phase separation of Compound **1** under certain storage conditions described herein (e.g., stabilized amorphous pharmaceutical compositions comprising Compound **1** and one or more additional components that do not show crystalline diffraction peaks by XRPD analysis (Method D) after 2 weeks of storage at 60 °C/75% RH (exposed), and/or show a single glass transition temperature (T_G) with no melt endotherm by DSC analysis (Method B) after 2 weeks of storage at 60 °C/75% RH (exposed)).

[0006] In some embodiments, the stabilized amorphous Compound **1** is obtained by spray drying a solution of Compound **1** with a stabilizing polymer. The inventors discovered that amorphous Compound **1** has higher oral bioavailability than certain crystalline forms of Compound **1**, including crystalline form Type A. Accordingly, in some embodiments, solid oral dosage forms comprising stabilized amorphous Compound **1** advantageously provide superior oral bioavailability of Compound **1** in comparison to solid oral dosage forms comprising certain crystalline forms of Compound **1**.

[0007] Also disclosed herein are an amorphous spray-dried dispersion (SDD) of Compound **1**, preparation methods thereof, and pharmaceutical compositions containing the same. The present disclosure provides various solid forms of Compound **1**, including one or more pharmaceutically acceptable crystalline and amorphous forms for Compound **1**, useful for the therapeutic oral administration of Compound **1**. The various solid forms of Compound **1** can be identified by certain characteristic properties. For example, certain crystalline forms of Compound **1** have distinct characteristic XRPD peaks.

[0008] Another aspect of the disclosure relates to solid forms of Compound **1**. Solid forms of Compound **1** disclosed herein include various crystalline forms (including Type A, Type B, Type C, Type D, Type E, Type F, Type G, Type H, Type I, Type J, Type K, Type L, and Type M) of Compound **1**, preparation methods thereof, and pharmaceutical compositions containing the same.

[0009] One aspect of the present disclosure relates to novel crystalline solid forms of Compound **1**:



[0010] A novel Compound **1** crystalline form Type A can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.61, 15.66, 23.19, and 24.76. A novel Compound **1** crystalline form Type A can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.7, 23.2, and 24.8. A novel Compound **1** crystalline form Type A can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 21.3, 23.2, and 24.8.

[0011] A novel Compound **1** crystalline form Type B can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.52, 15.57, 22.89, 23.34, and 25.13. A novel Compound **1** crystalline form Type B can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.9, 23.3, and 25.1. A novel Compound **1** crystalline form Type B can be identified by X-ray Powder Diffraction (XRPD) pattern having

one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.2, 22.9, 23.3, and 25.1.

[0012] A novel Compound 1 crystalline form Type C can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.55, 18.85, 23.02, and 24.65. A novel Compound 1 crystalline form Type C can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 18.9, 23.0, and 24.7. A novel Compound 1 crystalline form Type C can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 7.3, 11.2, 18.9, 23.0, and 24.7.

[0013] A novel Compound 1 crystalline form Type D can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 9.72, 13.08, 15.74, 21.90, and 23.59. A novel Compound 1 crystalline form Type D can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 9.7, 13.1, 15.7, 21.9, and 23.6. A novel Compound 1 crystalline form Type D can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 6.2, 9.7, 13.1, 15.7, 21.9, and 23.6 and not having a diffraction at an angle ($2\theta \pm 0.2$) of 23.3.

[0014] A novel Compound 1 crystalline form Type E can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 15.12, 15.75, 17.48, 20.05, 21.93, and 26.72. A novel Compound 1 crystalline form Type E can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 15.1, 15.8, 17.5, 20.1, 21.9, and 26.7. A novel Compound 1 crystalline form Type E can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 15.1, 15.8, 17.5, 20.1, 21.9, and 26.7.

[0015] A novel Compound 1 crystalline form Type F can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.45, 14.66, 16.00, 16.79, 20.01, 21.36, and 22.45. A novel Compound 1 crystalline form Type F can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, 20.0, 21.4, and 22.5. A novel Compound 1 crystalline form Type F can be identified by X-ray Powder Diffraction (XRPD)

pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, and 21.4.

[0016] A novel Compound 1 crystalline form Type G can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.36, 14.34, 16.58, and 21.35. A novel Compound 1 crystalline form Type G can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.3, 16.6, and 21.4. A novel Compound 1 crystalline form Type G can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.3, 16.6, 21.3, and 22.3.

[0017] A novel Compound 1 crystalline form Type H can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.8, 14.7, 16.6, 20.0, 21.3, and 25.4.

[0018] A novel Compound 1 crystalline form Type I can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.2, 14.6, 15.5, 20.2, and 21.1.

[0019] A novel Compound 1 crystalline form Type J can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.7, 22.8, 23.1, and 24.5.

[0020] A novel Compound 1 crystalline form Type K can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.4, 15.6, 16.1, 23.2, and 27.4.

[0021] A novel Compound 1 crystalline form Type L can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.9, 11.9, 17.8, 21.6, 23.9, and 36.1.

[0022] A novel Compound 1 crystalline form Type M can be identified by X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.8, 9.7, 15.6, 21.9, and 26.7.

[0023] Another aspect of the present disclosure relates to a pharmaceutical composition comprising a therapeutically effective amount of any of the crystalline solid forms of Compound 1 described above, and one or more pharmaceutically acceptable excipients.

[0024] Yet another aspect of the present disclosure relates to a novel amorphous solid dispersion of Compound 1. The novel amorphous solid form of Compound 1 can be prepared by spray-drying a mixture comprising Compound 1 and a polymer.

[0025] Still another aspect of the present disclosure relates to a pharmaceutical composition comprising the novel amorphous solid form of Compound 1 described above. The pharmaceutical composition may be in an oral dosage form, such as tablets.

[0026] Another aspect of the present disclosure relates to tablet dosage forms comprising Compound 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Fig. 1 depicts a reaction scheme to prepare Compound 1.

[0028] Fig. 2 depicts an alternative reaction scheme to prepare Compound 1.

[0029] Fig. 3 depicts an XRPD pattern of Compound 1 crystalline form Type A.

[0030] Fig. 4 depicts a thermogravimetric analysis (TGA) curve (upper curve) and a differential scanning calorimetry (DSC) thermogram (lower curve) for Compound 1 crystalline form Type A.

[0031] Fig. 5 depicts a DSC cycling thermogram for Compound 1 crystalline form Type A.

[0032] Fig. 6 depicts a dynamic vapor sorption (DVS) isotherm for Compound 1 crystalline form Type A.

[0033] Fig. 7 depicts an XRPD pattern of Compound 1 crystalline form Type B.

[0034] Fig. 8 depicts a thermogravimetric analysis (TGA) curve (upper curve) and a differential scanning calorimetry (DSC) thermogram (lower curve) for Compound 1 crystalline form Type B.

[0035] Fig. 9 depicts a DSC cycling thermogram for Compound 1 crystalline form Type B.

[0036] Fig. 10 depicts two thermogravimetric analysis (TGA) curves for Compound 1 crystalline form Type B.

[0037] Fig. 11 depicts a dynamic vapor sorption (DVS) isotherm for Compound 1 crystalline form Type B.

[0038] Fig. 12 depicts an XRPD pattern of Compound 1 crystalline form Type C.

- [0039] Fig. 13 depicts a thermogravimetric analysis (TGA) curve (upper curve) and a differential scanning calorimetry (DSC) thermogram (lower curve) for Compound 1 crystalline form Type C.
- [0040] Fig. 14 depicts a DSC cycling thermogram for Compound 1 crystalline form Type C.
- [0041] Fig. 15 depicts thermogravimetric analysis (TGA) curves for Compound 1 crystalline form Type C.
- [0042] Fig. 16 depicts a dynamic vapor sorption (DVS) isotherm for Compound 1 crystalline form Type C.
- [0043] Fig. 17 depicts an XRPD pattern of Compound 1 crystalline form Type D.
- [0044] Fig. 18 depicts a thermogravimetric analysis (TGA) curve (upper curve) and a differential scanning calorimetry (DSC) thermogram (lower curve) for Compound 1 crystalline form Type D.
- [0045] Fig. 19 depicts a ^1H NMR spectrum of Type A (upper curve) and Type D (lower curve) crystalline forms of Compound 1.
- [0046] Fig. 20 depicts an XRPD pattern of Compound 1 crystalline form Type E.
- [0047] Fig. 21 depicts an XRPD pattern of Compound 1 crystalline form Type F.
- [0048] Fig. 22 is a thermogravimetric analysis (TGA) curve (upper curve) and a differential scanning calorimetry (DSC) thermogram (lower curve) for Compound 1 crystalline form Type F.
- [0049] Fig. 23 depicts an XRPD pattern of Compound 1 crystalline form Type G.
- [0050] Fig. 24 depicts an XRPD pattern of Compound 1 crystalline form Type H.
- [0051] Fig. 25 depicts an XRPD pattern of Compound 1 crystalline form Type I.
- [0052] Fig. 26 depicts an XRPD pattern of Compound 1 crystalline form Type J.
- [0053] Fig. 27 depicts an XRPD pattern of Compound 1 crystalline form Type K.
- [0054] Fig. 28 depicts an XRPD pattern of Compound 1 crystalline form Type L.
- [0055] Fig. 29 depicts an XRPD pattern of Compound 1 crystalline form Type M.
- [0056] Fig. 30 depicts an XRPD pattern of a spray-dried dispersion (SDD) of Compound 1.
- [0057] Fig. 31 depicts a differential scanning calorimetry (DSC) thermogram for a spray-dried dispersion (SDD) of Compound 1.
- [0058] Fig. 32 depicts a graph of the plasma concentration over time following administration of three formulations of Compound 1 in rats.

[0059] Fig. 33 depicts a graph of the plasma concentration over time following administration of four formulations of Compound **1** in monkeys.

[0060] Fig. 34 depicts a graph of time-dependent solubility of Type A of Compound **1** in biorelevant media.

[0061] Fig. 35 depicts a graph of time-dependent solubility of a spray-dried dispersion (SDD) of Compound **1** in biorelevant media.

[0062] Fig. 36 depicts overlayed XRPD patterns of five spray-dried dispersions (SDDs) of Compound **1**, overlayed with the XRPD pattern of crystalline Compound **1** (Type A).

[0063] Fig. 37 depicts overlayed differential scanning calorimetry (DSC) thermograms of five spray-dried dispersions (SDDs) of Compound **1**.

[0064] Fig. 38 depicts a graph of the kinetic solubility profiles of five SDDs of Compound **1** at different drug loadings.

[0065] Fig. 39 depicts overlayed XRPD patterns of a spray dried dispersion of Compound **1** (SDD 0) after storage (a) in a sealed vial for 2 weeks at 60 °C, (b) in an unsealed vial for 2 weeks at 40 °C and 75% relative humidity, and (c) in an unsealed vial for 2 weeks at 60 °C and 75% relative humidity, overlayed with the XRPD pattern of crystalline Compound **1** (Type A).

[0066] Fig. 40 depicts overlayed XRPD patterns of a spray dried dispersion of Compound **1** (SDD 1) after storage (a) in a sealed vial for 2 weeks at 60 °C, (b) in an unsealed vial for 2 weeks at 40 °C and 75% relative humidity, and (c) in an unsealed vial for 2 weeks at 60 °C and 75% relative humidity, overlayed with the XRPD pattern of crystalline Compound **1** (Type A).

[0067] Fig. 41 depicts overlayed XRPD patterns of a spray dried dispersion of Compound **1** (SDD 2) after storage (a) in a sealed vial for 2 weeks at 60 °C, (b) in an unsealed vial for 2 weeks at 40 °C and 75% relative humidity, and (c) in an unsealed vial for 2 weeks at 60 °C and 75% relative humidity, overlayed with the XRPD pattern of crystalline Compound **1** (Type A).

[0068] Fig. 42 depicts overlayed XRPD patterns of a spray dried dispersion of Compound **1** (SDD 3) after storage (a) in a sealed vial for 2 weeks at 60 °C, (b) in an unsealed vial for 2 weeks at 40 °C and 75% relative humidity, and (c) in an unsealed vial for 2 weeks at 60 °C and 75% relative humidity, overlayed with the XRPD pattern of crystalline Compound **1** (Type A).

[0069] Fig. 43 depicts overlayed XRPD patterns of a spray dried dispersion of Compound **1** (SDD 4) after storage (a) in a sealed vial for 2 weeks at 60 °C, (b) in an unsealed vial for 2 weeks

at 40 °C and 75% relative humidity, and (c) in an unsealed vial for 2 weeks at 60 °C and 75% relative humidity, overlayed with the XRPD pattern of crystalline Compound 1 (Type A).

[0070] Fig. 44 depicts overlayed XRPD patterns of two spray dried dispersions of Compound 1 (SDDs 5 and 6), overlayed with the XRPD pattern of crystalline Compound 1 (Type A).

[0071] Fig. 45 depicts overlayed DSC thermograms of two spray dried dispersions of Compound 1 (SDDs 5 and 6).

[0072] Fig. 46 depicts overlayed XRPD patterns of a spray dried dispersion of Compound 1 (SDD 5) after storage (a) in a sealed vial for 1 week at 60 °C, (b) in an unsealed vial for 1 week at 25 °C and 60% relative humidity, and (c) in an unsealed vial for 1 week at 40 °C and 75% relative humidity.

[0073] Fig. 47 depicts overlayed DSC thermograms of a spray dried dispersion of Compound 1 (SDD 5) after storage (a) in a sealed vial for 1 week at 60 °C, (b) in an unsealed vial for 1 week at 25 °C and 60% relative humidity, and (c) in an unsealed vial for 1 week at 40 °C and 75% relative humidity.

[0074] Fig. 48 depicts overlayed DSC thermograms of a spray dried dispersion of Compound 1 (SDD 5) after storage (a) in a sealed vial for 2 weeks at 60 °C, (b) in an unsealed vial for 2 weeks at 25 °C and 60% relative humidity, and (c) in an unsealed vial for 2 weeks at 40 °C and 75% relative humidity.

[0075] Fig. 49 depicts overlayed XRPD patterns of a spray dried dispersion of Compound 1 (SDD 6) after storage (a) in a sealed vial for 1 week at 60 °C, (b) in an unsealed vial for 1 week at 25 °C and 60% relative humidity, and (c) in an unsealed vial for 1 week at 40 °C and 75% relative humidity.

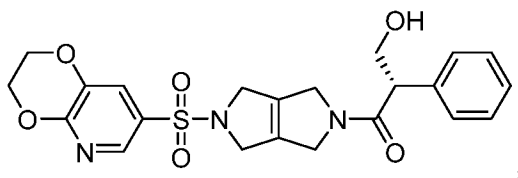
[0076] Fig. 50 depicts overlayed DSC thermograms of a spray dried dispersion of Compound 1 (SDD 6) after storage (a) in a sealed vial for 1 week at 60 °C, (b) in an unsealed vial for 1 week at 25 °C and 60% relative humidity, and (c) in an unsealed vial for 1 week at 40 °C and 75% relative humidity.

[0077] Fig. 51 depicts overlayed DSC thermograms of a spray dried dispersion of Compound 1 (SDD 6) after storage (a) in a sealed vial for 2 weeks at 60 °C, (b) in an unsealed vial for 2 weeks at 25 °C and 60% relative humidity, and (c) in an unsealed vial for 2 weeks at 40 °C and 75% relative humidity.

[0078] Fig. 52 depicts a graph of the dissolution profile of a tablet formulation of Compound 1.

DETAILED DESCRIPTION

[0079] The chemical compound (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one (“Compound 1”),



is a small molecule modulator of pyruvate kinase. The present disclosure provides various solid forms of Compound 1, pharmaceutical compositions thereof, and methods of preparing those novel solid forms of Compound 1. The solid forms described herein (e.g., crystalline solid forms and amorphous solid forms) are associated with favorable characteristics such as favorable or improved solubility, dissolution, bioavailability, stability, and ease of formulation relative to other forms of Compound 1. For example, certain amorphous solid dispersions described herein advantageously have high drug loads (e.g., $\geq 25\%$, $\geq 40\%$, $\geq 50\%$, etc.), are free or substantially free of crystalline Compound 1, are physically stable (i.e., remain free or substantially free of crystalline Compound 1 over time in accelerated stability studies), are highly soluble, and/or do not require extensive drying to remove residual solvents. Further, certain tablet dosage forms described herein advantageously have high drug loads (e.g., ≥ 10 weight % of the tablet core, ≥ 15 weight % of the tablet core, ≥ 30 weight % of the tablet core), small tablet sizes (e.g., tablet core weight ≤ 1200 mg, ≤ 1000 mg, ≤ 800 mg, ≤ 700 mg, etc. per tablet), are free or substantially free of crystalline Compound 1, and/or are physically stable (i.e., remain free or substantially free of crystalline Compound 1 over time in accelerated stability studies).

[0080] In some embodiments, Compound 1 is in a crystalline solid form (e.g., Type A, Type B, Type C, Type D, Type E, Type F, or Type G). In some embodiments, Compound 1 is in a crystalline solid form (e.g., Type A, Type B, Type C, Type D, Type E, Type F, Type G, Type H, Type I, Type J, Type K, Type L, or Type M). In some embodiments, the crystalline solid form is Type A. In some embodiments, the crystalline solid form is Type B. In some embodiments, the

crystalline solid form is Type C. In some embodiments, the crystalline solid form is Type D. In some embodiments, the crystalline solid form is Type E. In some embodiments, the crystalline solid form is Type F. In some embodiments, the crystalline solid form is Type G. In some embodiments, the crystalline solid form is Type H. In some embodiments, the crystalline solid form is Type I. In some embodiments, the crystalline solid form is Type J. In some embodiments, the crystalline solid form is Type K. In some embodiments, the crystalline solid form is Type L. In some embodiments, the crystalline solid form is Type M.

[0081] In some embodiments, Compound **1** is in amorphous form (e.g., an amorphous solid dispersion). In some embodiments, the amorphous solid dispersion comprises Compound **1** and a polymer.

Compound 1 Crystalline Form Type A

[0082] A novel Compound **1** crystalline form Type A can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.61, 15.66, 23.19, and 24.76. A novel Compound **1** crystalline form Type A can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.7, 23.2, and 24.8. In some embodiments, Compound **1** crystalline form Type A can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.61, 15.66, 23.19, and 24.76, corresponding to d-spacing (angstroms ± 0.2) of 19.19, 5.66, 3.84, and 3.60, respectively. In some embodiments, Compound **1** crystalline form Type A can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.7, 23.2, and 24.8, corresponding to d-spacing (angstroms ± 0.2) of 19.2, 5.7, 3.8, and 3.6, respectively.

[0083] In some embodiments, Compound **1** crystalline form Type A can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 21.3, 23.2, and 24.8. In some embodiments, Compound **1** crystalline form Type A can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 21.3, 23.2, and 24.8, corresponding to d-spacing (angstroms ± 0.2) of 19.2, 12.3, 5.7, 4.2, 3.8, and 3.6, respectively.

[0084] In some embodiments, Compound **1** crystalline form Type A can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.61, 7.22,

15.66, 20.48, 21.35, 21.66, 22.47, 23.19, 24.76, and 26.73. In some embodiments, Compound 1 crystalline form Type A can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 20.5, 21.4, 21.7, 22.5, 23.2, 24.8, and 26.7. In some embodiments, Compound 1 crystalline form Type A can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.61, 7.22, 15.66, 20.48, 21.35, 21.66, 22.47, 23.19, 24.76, and 26.73, corresponding to d-spacing (angstroms ± 0.2) of 19.19, 12.25, 5.66, 4.34, 4.16, 4.10, 3.96, 3.84, 3.60, and 3.34, respectively. In some embodiments, Compound 1 crystalline form Type A can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 20.5, 21.4, 21.7, 22.5, 23.2, 24.8, and 26.7, corresponding to d-spacing (angstroms ± 0.2) of 19.2, 12.2, 5.7, 4.3, 4.2, 4.1, 4.0, 3.8, 3.6, and 3.3, respectively.

[0085] In some embodiments, Compound 1 crystalline form Type A is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.61
5.80
7.22
7.68
11.21
12.31
14.44
15.66
16.95
18.02
19.20
20.48
21.35
21.66
22.47
23.19
24.76
26.73
28.01
28.49
29.35
30.25
32.14
34.12

36.46

[0086] In some embodiments, Compound **1** crystalline form Type A is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.6
5.8
7.2
7.7
11.2
12.3
14.4
15.7
16.9
18.0
19.2
20.5
21.3
21.7
22.5
23.2
24.8
26.7
28.0
28.5
29.4
30.3
32.1
34.1
36.5

[0087] In some embodiments, Compound **1** crystalline form Type A is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.61	19.19
5.80	15.24
7.22	12.25
7.68	11.50
11.21	7.89
12.31	7.19
14.44	6.13
15.66	5.66
16.95	5.23
18.02	4.92
19.20	4.62
20.48	4.34
21.35	4.16
21.66	4.10
22.47	3.96
23.19	3.84
24.76	3.60
26.73	3.34
28.01	3.19
28.49	3.13
29.35	3.04
30.25	2.95
32.14	2.79
34.12	2.63
36.46	2.46

[0088] In some embodiments, Compound **1** crystalline form Type A is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.6	19.2
5.8	15.2
7.2	12.2
7.7	11.5
11.2	7.9
12.3	7.2
14.4	6.1
15.7	5.7
16.9	5.2
18.0	4.9
19.2	4.6
20.5	4.3
21.3	4.2
21.7	4.1
22.5	4.0
23.2	3.8
24.8	3.6
26.7	3.3
28.0	3.2
28.5	3.1
29.4	3.0
30.3	3.0
32.1	2.8
34.1	2.6
36.5	2.5

[0089] In some embodiments, Compound 1 crystalline form Type A is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 1.9% up to 100 °C. In some embodiments, Compound 1 crystalline form Type A is characterized by a differential scanning calorimetry (DSC) endotherm having a peak temperature of about 85.9 °C and an onset temperature of about 146.0 °C. In some embodiments, Compound 1 crystalline form Type A is characterized by a dynamic vapor sorption (DVS) of about 3.4% water uptake by weight up to 40% relative humidity. In some embodiments, Compound 1 crystalline form Type A is characterized by a dynamic vapor sorption (DVS) of about 1.0% water uptake by weight from 40% to 80% relative humidity.

Compound 1 Crystalline Form Type B

[0090] A novel Compound 1 crystalline form Type B can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.52, 15.57, 22.89, 23.34, and 25.13. A novel Compound 1 crystalline form Type B can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.9, 23.3, and 25.1. In some embodiments, Compound 1 crystalline form Type B can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.52, 15.57, 22.89, 23.34, and 25.13, corresponding to d-spacing (angstroms ± 0.2) of 19.53, 5.69, 3.89, 3.81, and 3.54, respectively. In some embodiments, Compound 1 crystalline form Type B can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.9, 23.3, and 25.1, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 5.7, 3.9, 3.8, and 3.5, respectively.

[0091] In some embodiments, Compound 1 crystalline form Type B can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.2, 22.9, 23.3, and 25.1. In some embodiments, Compound 1 crystalline form Type B can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.2, 22.9, 23.3, and 25.1, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 5.7, 4.0, 3.9, 3.8, and 3.5, respectively.

[0092] In some embodiments, Compound 1 crystalline form Type B can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.52, 9.86, 15.57, 19.93, 22.19, 22.89, 23.34, 25.13, and 28.30. In some embodiments, Compound 1 crystalline form Type B can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 9.9, 15.6, 19.9, 22.2, 22.9, 23.3, 25.1, and 28.3. In some embodiments, Compound 1 crystalline form Type B can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.52, 9.86, 15.57, 19.93, 22.19, 22.89, 23.34, 25.13, and 28.30, corresponding to d-spacing (angstroms ± 0.2) of 19.53, 8.97, 5.69, 4.45, 4.00, 3.89, 3.81, 3.54, and 3.15, respectively. In some embodiments, Compound 1 crystalline form Type B can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 9.9, 15.6, 19.9, 22.2, 22.9, 23.3, 25.1, and 28.3, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 9.0, 5.7, 4.5, 4.0, 3.9, 3.8, 3.5, and 3.2, respectively.

[0093] In some embodiments, Compound **1** crystalline form Type B is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.52
8.98
9.86
12.37
13.18
15.57
16.86
18.21
19.11
19.93
20.92
22.19
22.89
23.34
25.13
25.80
26.71
28.30
29.39

[0094] In some embodiments, Compound **1** crystalline form Type B is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.5
9.0
9.9
12.4
13.2
15.6
16.9
18.2
19.1
19.9
20.9
22.2
22.9
23.3
25.1
25.8

26.7
28.3
29.4

[0095] In some embodiments, Compound **1** crystalline form Type B is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.52	19.53
8.98	9.85
9.86	8.97
12.37	7.15
13.18	6.72
15.57	5.69
16.86	5.26
18.21	4.87
19.11	4.64
19.93	4.45
20.92	4.25
22.19	4.00
22.89	3.89
23.34	3.81
25.13	3.54
25.80	3.45
26.71	3.34
28.30	3.15
29.39	3.04

[0096] In some embodiments, Compound **1** crystalline form Type B is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.5	19.5
9.0	9.9
9.9	9.0
12.4	7.2
13.2	6.7

2 theta	d-spacing
15.6	5.7
16.9	5.3
18.2	4.9
19.1	4.6
19.9	4.5
20.9	4.2
22.2	4.0
22.9	3.9
23.3	3.8
25.1	3.5
25.8	3.5
26.7	3.3
28.3	3.2
29.4	3.0

[0097] In some embodiments, Compound 1 crystalline form Type B is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 1.8% up to 100 °C, and/or a thermogravimetric analysis (TGA) thermogram with a weight loss of about 2.3% up to 120 °C. In some embodiments, Compound 1 crystalline form Type B is characterized by a differential scanning calorimetry (DSC) endotherm having an onset temperature of about 138.2-139.2 °C. In some embodiments, Compound 1 crystalline form Type B is characterized by a dynamic vapor sorption (DVS) of about 2.9% water uptake by weight up to 60% relative humidity, and a dynamic vapor sorption (DVS) of about 0.4% water uptake by weight from 60% to 80% relative humidity.

Compound 1 Crystalline Form Type C

[0098] A novel Compound 1 crystalline form Type C can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.55, 18.85, 23.02, and 24.65. A novel Compound 1 crystalline form Type C can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.5, 18.9, 23.0, and 24.7. In some embodiments, Compound 1 crystalline form Type C can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.55, 18.85, 23.02, and 24.65, corresponding

to d-spacing (angstroms $\pm$ 0.2) of 19.43, 4.71, 3.86, and 3.61, respectively. In some embodiments, Compound 1 crystalline form Type C can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.5, 18.9, 23.0, and 24.7, corresponding to d-spacing (angstroms $\pm$ 0.2) of 19.4, 4.7, 3.9, and 3.6, respectively.

[0099] In some embodiments, Compound 1 crystalline form Type C can be identified by an XRPD pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.5, 7.3, 11.2, 18.9, 23.0, and 24.7. In some embodiments, Compound 1 crystalline form Type C can be identified by XRPD, having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.5, 7.3, 11.2, 18.9, 23.0, and 24.7, corresponding to d-spacing (angstroms $\pm$ 0.2) of 19.4, 12.0, 7.9, 4.7, 3.9, and 3.6, respectively.

[0100] In some embodiments, Compound 1 crystalline form Type C can be identified by an XRPD pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.55, 7.34, 9.07, 11.17, 18.34, 18.85, 19.57, 21.66, 23.02, and 24.65. In some embodiments, Compound 1 crystalline form Type C can be identified by an XRPD pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.5, 7.3, 9.1, 11.2, 18.34, 18.9, 19.6, 21.7, 23.0, and 24.7. In some embodiments, Compound 1 crystalline form Type C can be identified by XRPD, having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.55, 7.34, 9.07, 11.17, 18.34, 18.85, 19.57, 21.66, 23.02, and 24.65, corresponding to d-spacing (angstroms $\pm$ 0.2) of 19.43, 12.05, 9.75, 7.92, 4.84, 4.71, 4.54, 4.10, 3.86, and 3.61, respectively. In some embodiments, Compound 1 crystalline form Type C can be identified by XRPD, having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.5, 7.3, 9.1, 11.2, 18.3, 18.9, 19.6, 21.7, 23.0, and 24.7, corresponding to d-spacing (angstroms $\pm$ 0.2) of 19.4, 12.0, 9.8, 7.9, 4.8, 4.7, 4.5, 4.1, 3.9, and 3.6, respectively.

[0101] In some embodiments, Compound 1 crystalline form Type C is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of:

4.55
7.34
9.07
11.17
12.29
14.51
15.66
18.34

18.85
19.57
20.38
21.66
23.02
24.65
26.39
28.28
30.09
32.31
33.91
37.19

[0102] In some embodiments, Compound **1** crystalline form Type C is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.5
7.3
9.1
11.2
12.3
14.5
15.7
18.3
18.9
19.6
20.4
21.7
23.0
24.7
26.4
28.3
30.1
32.3
33.9
37.2

[0103] In some embodiments, Compound **1** crystalline form Type C is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.55	19.43
7.34	12.05
9.07	9.75
11.17	7.92
12.29	7.20
14.51	6.11
15.66	5.66
18.34	4.84
18.85	4.71
19.57	4.54
20.38	4.36
21.66	4.10
23.02	3.86
24.65	3.61
26.39	3.38
28.28	3.16
30.09	2.97
32.31	2.77
33.91	2.64
37.19	2.42

[0104] In some embodiments, Compound **1** crystalline form Type C is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) and corresponding d-spacing (angstroms $\pm$ 0.2) of:

2 theta	d-spacing
4.5	19.4
7.3	12.0
9.1	9.8
11.2	7.9
12.3	7.2
14.5	6.1
15.7	5.7
18.3	4.8
18.9	4.7
19.6	4.5
20.4	4.4
21.7	4.1
23.0	3.9
24.7	3.6

2 theta	d-spacing
26.4	3.4
28.3	3.2
30.1	3.0
32.3	2.8
33.9	2.6
37.2	2.4

[0105] In some embodiments, Compound 1 crystalline form Type C is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 1.0% up to 100 °C, and/or a thermogravimetric analysis (TGA) thermogram with a weight loss of about 2.3% up to 130 °C. In some embodiments, Compound 1 crystalline form Type C is characterized by a differential scanning calorimetry (DSC) endotherm having an onset temperature of about 152.2-154.2 °C. In some embodiments, Compound 1 crystalline form Type C is characterized by a dynamic vapor sorption (DVS) of about 1.8% water uptake by weight up to 60% relative humidity, and a dynamic vapor sorption (DVS) of about 0.5% water uptake by weight from 60% to 80% relative humidity.

Compound 1 Crystalline Form Type D

[0106] A novel Compound 1 crystalline form Type D can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 9.72, 13.08, 15.74, 21.90, and 23.59. A novel Compound 1 crystalline form Type D can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 9.7, 13.1, 15.7, 21.9, and 23.6. In some embodiments, Compound 1 crystalline form Type D can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 9.72, 13.08, 15.74, 21.90, and 23.59, corresponding to d-spacing (angstroms $\pm$ 0.2) of 9.10, 6.77, 5.63, 4.06 and 3.77, respectively. In some embodiments, Compound 1 crystalline form Type D can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 9.7, 13.1, 15.7, 21.9, and 23.6, corresponding to d-spacing (angstroms $\pm$ 0.2) of 9.1, 6.8, 5.6, 4.1 and 3.8, respectively.

[0107] In some embodiments, Compound **1** crystalline form Type D can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 6.2, 9.7, 13.1, 15.7, 21.9, and 23.6 and not having a diffraction at an angle ($2\theta \pm 0.2$) of 23.3. In some embodiments, Compound **1** crystalline form Type D can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 6.2, 9.7, 13.1, 15.7, 21.9, and 23.6, corresponding to d-spacing (angstroms ± 0.2) of 14.4, 9.1, 6.8, 5.6, 4.1 and 3.8, respectively, and not having a diffraction at an angle ($2\theta \pm 0.2$) of 23.3.

[0108] In some embodiments, Compound **1** crystalline form Type D can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.27, 6.15, 8.71, 9.72, 12.31, 13.08, 13.76, 15.74, 18.02, 21.90, 23.59, and 26.71. In some embodiments, Compound **1** crystalline form Type D can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.3, 6.2, 8.7, 9.7, 12.3, 13.1, 13.8, 15.7, 18.0, 21.9, 23.6, and 26.7. In some embodiments, Compound **1** crystalline form Type D can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.27, 6.15, 8.71, 9.72, 12.31, 13.08, 13.76, 15.74, 18.02, 21.90, 23.59, and 26.71, corresponding to d-spacing (angstroms ± 0.2) of 20.68, 14.36, 10.16, 9.10, 7.19, 6.77, 6.44, 5.63, 4.92, 4.06, 3.77, and 3.34, respectively. In some embodiments, Compound **1** crystalline form Type D can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.3, 6.2, 8.7, 9.7, 12.3, 13.1, 13.8, 15.7, 18.0, 21.9, 23.6, and 26.7, corresponding to d-spacing (angstroms ± 0.2) of 20.7, 14.4, 10.2, 9.1, 7.2, 6.8, 6.4, 5.6, 4.9, 4.1, 3.8, and 3.3, respectively.

[0109] In some embodiments, Compound **1** crystalline form Type D is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.27
6.15
8.71
9.72
12.31
13.08
13.76
15.74
18.02
19.55
21.90
23.59

24.79
26.71
29.50
30.82
31.74
35.40
37.84
38.61

[0110] In some embodiments, Compound **1** crystalline form Type D is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.3
6.2
8.7
9.7
12.3
13.1
13.8
15.7
18.0
19.5
21.9
23.6
24.8
26.7
29.5
30.8
31.7
35.4
37.8
38.6

[0111] In some embodiments, Compound **1** crystalline form Type D is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.27	20.68
6.15	14.36

2 theta	d-spacing
8.71	10.16
9.72	9.10
12.31	7.19
13.08	6.77
13.76	6.44
15.74	5.63
18.02	4.92
19.55	4.54
21.90	4.06
23.59	3.77
24.79	3.59
26.71	3.34
29.50	3.03
30.82	2.90
31.74	2.82
35.40	2.54
37.84	2.38
38.61	2.33

[0112] In some embodiments, Compound **1** crystalline form Type D is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) and corresponding d-spacing (angstroms $\pm$ 0.2) of:

2 theta	d-spacing
4.3	20.7
6.2	14.4
8.7	10.2
9.7	9.1
12.3	7.2
13.1	6.8
13.8	6.4
15.7	5.6
18.0	4.9
19.5	4.5
21.9	4.1
23.6	3.8
24.8	3.6
26.7	3.3
29.5	3.0
30.8	2.9

2 theta	d-spacing
31.7	2.8
35.4	2.5
37.8	2.4
38.6	2.3

[0113] In some embodiments, Compound **1** crystalline form Type D is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 9.6% up to 130 °C. In some embodiments, Compound **1** crystalline form Type D is characterized by a differential scanning calorimetry (DSC) endotherm having an onset temperature of about 91.9 °C.

Compound 1 Crystalline Form Type E

[0114] A novel Compound **1** crystalline form Type E can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 15.12, 15.75, 17.48, 20.05, 21.93, and 26.72. A novel Compound **1** crystalline form Type E can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 15.1, 15.8, 17.5, 20.1, 21.9, and 26.7. In some embodiments, Compound **1** crystalline form Type E can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 15.12, 15.75, 17.48, 20.05, 21.93, and 26.72, corresponding to d-spacing (angstroms $\pm$ 0.2) of 5.86, 5.63, 5.07, 4.43, 4.05, and 3.34, respectively. In some embodiments, Compound **1** crystalline form Type E can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 15.1, 15.8, 17.5, 20.1, 21.9, and 26.7, corresponding to d-spacing (angstroms $\pm$ 0.2) of 5.9, 5.6, 5.1, 4.4, 4.1, and 3.3, respectively.

[0115] In some embodiments, Compound **1** crystalline form Type E can be identified by an XRPD pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 15.1, 15.8, 17.5, 20.1, 21.9, and 26.7. In some embodiments, Compound **1** crystalline form Type E can be identified by XRPD, having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 15.1, 15.8, 17.5, 19.0, 20.1, 21.9, and 26.7, corresponding to d-spacing (angstroms $\pm$ 0.2) of 5.9, 5.6, 5.1, 4.7, 4.4, 4.1, and 3.3, respectively.

[0116] In some embodiments, Compound **1** crystalline form Type E can be identified by an XRPD pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 4.59, 15.12,

15.75, 17.48, 20.05, 21.93, 23.18, 23.70, and 26.72. In some embodiments, Compound 1 crystalline form Type E can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.1, 15.8, 17.5, 20.1, 21.9, 23.2, 23.7, and 26.7. In some embodiments, Compound 1 crystalline form Type E can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.59, 15.12, 15.75, 17.48, 20.05, 21.93, 23.18, 23.70, and 26.72, corresponding to d-spacing (angstroms ± 0.2) of 19.27, 5.86, 5.63, 5.07, 4.43, 4.05, 3.84, 3.75, and 3.34, respectively. In some embodiments, Compound 1 crystalline form Type E can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.1, 15.8, 17.5, 20.1, 21.9, 23.2, 23.7, and 26.7, corresponding to d-spacing (angstroms ± 0.2) of 19.3, 5.9, 5.6, 5.1, 4.4, 4.1, 3.8, 3.8, and 3.3, respectively.

[0117] In some embodiments, Compound 1 crystalline form Type E can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.59, 9.76, 12.36, 13.12, 15.12, 15.75, 16.84, 17.48, 18.06, 19.02, 20.05, 21.93, 23.18, 23.70, 26.72, and 27.81. In some embodiments, Compound 1 crystalline form Type E can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 9.8, 12.4, 13.1, 15.1, 15.8, 16.8, 17.5, 18.1, 19.0, 20.1, 21.9, 23.2, 23.7, 26.7, and 27.8. In some embodiments, Compound 1 crystalline form Type E can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.59, 9.76, 12.36, 13.12, 15.12, 15.75, 16.84, 17.48, 18.06, 19.02, 20.05, 21.93, 23.18, 23.70, 26.72, and 27.81, corresponding to d-spacing (angstroms ± 0.2) of 19.27, 9.06, 7.16, 6.75, 5.86, 5.63, 5.27, 5.07, 4.91, 4.67, 4.43, 4.05, 3.84, 3.75, 3.34, and 3.21, respectively. In some embodiments, Compound 1 crystalline form Type E can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 9.8, 12.4, 13.1, 15.1, 15.8, 16.8, 17.5, 18.1, 19.0, 20.1, 21.9, 23.2, 23.7, 26.7, and 27.8, corresponding to d-spacing (angstroms ± 0.2) of 19.3, 9.1, 7.2, 6.7, 5.9, 5.6, 5.3, 5.1, 4.9, 4.7, 4.4, 4.1, 3.8, 3.8, 3.3, and 3.2, respectively.

[0118] In some embodiments, Compound 1 crystalline form Type E is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.59
8.76
9.76
12.36
13.12

13.83
15.12
15.75
16.84
17.48
18.06
19.02
20.05
21.93
23.18
23.70
24.82
26.72
27.81
29.51
30.76
31.74
33.03
34.52
35.39
36.72
37.77
38.66

[0119] In some embodiments, Compound **1** crystalline form Type E is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.6
8.8
9.8
12.4
13.1
13.8
15.1
15.8
16.8
17.5
18.1
19.0
20.1
21.9
23.2

23.7
24.8
26.7
27.8
29.5
30.8
31.7
33.0
34.5
35.4
36.7
37.8
38.7

[0120] In some embodiments, Compound **1** crystalline form Type E is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.59	19.27
8.76	10.09
9.76	9.06
12.36	7.16
13.12	6.75
13.83	6.40
15.12	5.86
15.75	5.63
16.84	5.27
17.48	5.07
18.06	4.91
19.02	4.67
20.05	4.43
21.93	4.05
23.18	3.84
23.70	3.75
24.82	3.59
26.72	3.34
27.81	3.21
29.51	3.03
30.76	2.91
31.74	2.82

2 theta	d-spacing
33.03	2.71
34.52	2.60
35.39	2.54
36.72	2.45
37.77	2.38
38.66	2.33

[0121] In some embodiments, Compound **1** crystalline form Type E is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) and corresponding d-spacing (angstroms $\pm$ 0.2) of:

2 theta	d-spacing
4.6	19.3
8.8	10.1
9.8	9.1
12.4	7.2
13.1	6.7
13.8	6.4
15.1	5.9
15.8	5.6
16.8	5.3
17.5	5.1
18.1	4.9
19.0	4.7
20.1	4.4
21.9	4.1
23.2	3.8
23.7	3.8
24.8	3.6
26.7	3.3
27.8	3.2
29.5	3.0
30.8	2.9
31.7	2.8
33.0	2.7
34.5	2.6
35.4	2.5
36.7	2.4

2 theta	d-spacing
37.8	2.4
38.7	2.3

Compound 1 Crystalline Form Type F

[0122] A novel Compound **1** crystalline form Type F can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.45, 14.66, 16.00, 16.79, 20.01, 21.36, and 22.45. A novel Compound **1** crystalline form Type F can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, 20.0, 21.4, and 22.5. In some embodiments, Compound **1** crystalline form Type F can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.45, 14.66, 16.00, 16.79, 20.01, 21.36, and 22.45, corresponding to d-spacing (angstroms ± 0.2) of 16.23, 6.04, 5.54, 5.28, 4.44, 4.16, and 3.96, respectively. In some embodiments, Compound **1** crystalline form Type F can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, 20.0, 21.4, and 22.5, corresponding to d-spacing (angstroms ± 0.2) of 16.2, 6.0, 5.5, 5.3, 4.4, 4.2, and 4.0, respectively.

[0123] In some embodiments, Compound **1** crystalline form Type F can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, and 21.4. In some embodiments, Compound **1** crystalline form Type F can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, and 21.4, corresponding to d-spacing (angstroms ± 0.2) of 16.2, 6.0, 5.5, 5.3, and 4.2, respectively.

[0124] In some embodiments, Compound **1** crystalline form Type F can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.45, 14.66, 16.00, 16.79, 18.99, 20.01, 21.36, 22.45, 23.25, and 25.32. In some embodiments, Compound **1** crystalline form Type F can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, 19.0, 20.0, 21.4, 22.5, 23.2, and 25.3. In some embodiments, Compound **1** crystalline form Type F can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.45, 14.66, 16.00, 16.79, 18.99,

20.01, 21.36, 22.45, 23.25, and 25.32, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.23, 6.04, 5.54, 5.28, 4.67, 4.44, 4.16, 3.96, 3.83, and 3.52, respectively. In some embodiments, Compound 1 crystalline form Type F can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, 19.0, 20.0, 21.4, 22.5, 23.2, and 25.3, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.2, 6.0, 5.5, 5.3, 4.7, 4.4, 4.2, 4.0, 3.8, and 3.5, respectively.

[0125] In some embodiments, Compound 1 crystalline form Type F can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.45, 12.87, 14.66, 16.00, 16.79, 17.36, 18.99, 20.01, 20.57, 21.36, 22.45, 23.25, 25.32, 26.57, 27.25, 27.97, and 30.02. In some embodiments, Compound 1 crystalline form Type F can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.9, 14.7, 16.0, 16.8, 17.4, 19.0, 20.0, 20.6, 21.4, 22.5, 23.2, 25.3, 26.6, 27.2, 28.0, and 30.0. In some embodiments, Compound 1 crystalline form Type F can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.45, 12.87, 14.66, 16.00, 16.79, 17.36, 18.99, 20.01, 20.57, 21.36, 22.45, 23.25, 25.32, 26.57, 27.25, 27.97, and 30.02, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.23, 6.88, 6.04, 5.54, 5.28, 5.11, 4.67, 4.44, 4.32, 4.16, 3.96, 3.83, 3.52, 3.35, 3.27, 3.19, and 2.98, respectively. In some embodiments, Compound 1 crystalline form Type F can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.9, 14.7, 16.0, 16.8, 17.4, 19.0, 20.0, 20.6, 21.4, 22.5, 23.2, 25.3, 26.6, 27.2, 28.0, and 30.0, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.2, 6.9, 6.0, 5.5, 5.3, 5.1, 4.7, 4.4, 4.3, 4.2, 4.0, 3.8, 3.5, 3.4, 3.3, 3.2, and 3.0, respectively.

[0126] In some embodiments, Compound 1 crystalline form Type F is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

5.45
10.92
12.87
14.66
16.00
16.79
17.36
18.99
20.01
20.57
21.36

22.45
23.25
25.32
26.57
27.25
27.97
30.02
31.98
32.89
38.29
39.09

[0127] In some embodiments, Compound **1** crystalline form Type F is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

5.4
10.9
12.9
14.7
16.0
16.8
17.4
19.0
20.0
20.6
21.4
22.5
23.2
25.3
26.6
27.2
28.0
30.0
32.0
32.9
38.3
39.1

[0128] In some embodiments, Compound **1** crystalline form Type F is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
5.45	16.23
10.92	8.10
12.87	6.88
14.66	6.04
16.00	5.54
16.79	5.28
17.36	5.11
18.99	4.67
20.01	4.44
20.57	4.32
21.36	4.16
22.45	3.96
23.25	3.83
25.32	3.52
26.57	3.35
27.25	3.27
27.97	3.19
30.02	2.98
31.98	2.80
32.89	2.72
38.29	2.35
39.09	2.30

[0129] In some embodiments, Compound **1** crystalline form Type F is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
5.4	16.2
10.9	8.1
12.9	6.9
14.7	6.0
16.0	5.5
16.8	5.3
17.4	5.1

2 theta	d-spacing
19.0	4.7
20.0	4.4
20.6	4.3
21.4	4.2
22.5	4.0
23.2	3.8
25.3	3.5
26.6	3.4
27.2	3.3
28.0	3.2
30.0	3.0
32.0	2.8
32.9	2.7
38.3	2.4
39.1	2.3

[0130] In some embodiments, Compound 1 crystalline form Type F is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 6.2% up to 120 °C. In some embodiments, Compound 1 crystalline form Type F is characterized by a differential scanning calorimetry (DSC) endotherm having a peak temperature of about 100.4 °C and an onset temperature of 125.9 °C.

Compound 1 Crystalline Form Type G

[0131] A novel Compound 1 crystalline form Type G can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 5.36, 14.34, 16.58, and 21.35. A novel Compound 1 crystalline form Type G can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 5.4, 14.3, 16.6, and 21.4. In some embodiments, Compound 1 crystalline form Type G can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 5.36, 14.34, 16.58, and 21.35, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.48, 6.18, 5.35, and 4.16, respectively. In some embodiments, Compound 1 crystalline form Type G can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles (2 theta $\pm$ 0.2) of 5.4, 14.3, 16.6, and 21.4, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.5, 6.2, 5.3, and 4.2, respectively.

[0132] In some embodiments, Compound **1** crystalline form Type G can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.3, 16.6, 21.3, and 22.3. In some embodiments, Compound **1** crystalline form Type G can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.3, 16.6, 21.3, and 22.3, corresponding to d-spacing (angstroms ± 0.2) of 16.5, 6.2, 5.3, 4.2, and 4.0, respectively.

[0133] In some embodiments, Compound **1** crystalline form Type G can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.36, 12.83, 14.34, 15.00, 16.58, 19.78, 21.35, 22.35, 25.33, and 26.43. In some embodiments, Compound **1** crystalline form Type G can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.8, 14.3, 15.0, 16.6, 19.8, 21.3, 22.3, 25.3, and 26.4. In some embodiments, Compound **1** crystalline form Type G can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.36, 12.83, 14.34, 15.00, 16.58, 19.78, 21.35, 22.35, 25.33, and 26.43, corresponding to d-spacing (angstroms ± 0.2) of 16.48, 6.90, 6.18, 5.91, 5.35, 4.49, 4.16, 3.98, 3.52, and 3.37, respectively. In some embodiments, Compound **1** crystalline form Type G can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.8, 14.3, 15.0, 16.6, 19.8, 21.3, 22.3, 25.3, and 26.4, corresponding to d-spacing (angstroms ± 0.2) of 16.5, 6.9, 6.2, 5.9, 5.3, 4.5, 4.2, 4.0, 3.5, and 3.4, respectively.

[0134] In some embodiments, Compound **1** crystalline form Type G can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.36, 12.83, 14.34, 15.00, 15.79, 16.58, 19.78, 21.35, 22.35, 25.33, 26.43, 27.35, and 30.21. In some embodiments, Compound **1** crystalline form Type G can be identified by an XRPD pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.34, 12.8, 14.3, 15.0, 15.8, 16.6, 19.8, 21.3, 22.3, 25.3, 26.4, 27.4, and 30.2. In some embodiments, Compound **1** crystalline form Type G can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.36, 12.83, 14.34, 15.00, 15.79, 16.58, 19.78, 21.35, 22.35, 25.33, 26.43, 27.35, and 30.21, corresponding to d-spacing (angstroms ± 0.2) of 16.48, 6.90, 6.18, 5.91, 5.61, 5.35, 4.49, 4.16, 3.98, 3.52, 3.37, 3.26, and 2.96, respectively. In some embodiments, Compound **1** crystalline form Type G can be identified by XRPD, having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.8, 14.3, 15.0, 15.8, 16.6, 19.8, 21.3, 22.3, 25.3, 26.4, 27.4, and

30.2, corresponding to d-spacing (angstroms ± 0.2) of 16.5, 6.9, 6.2, 5.9, 5.6, 5.3, 4.5, 4.2, 4.0, 3.5, 3.4, 3.3, and 3.0, respectively.

[0135] In some embodiments, Compound **1** crystalline form Type G is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

5.36
8.73
12.83
14.34
15.00
15.79
16.58
18.54
19.78
21.35
22.35
23.38
25.33
26.43
27.35
30.21
32.32
38.04

[0136] In some embodiments, Compound **1** crystalline form Type G is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

5.4
8.7
12.8
14.3
15.0
15.8
16.6
18.5
19.8
21.3
22.3
23.4
25.3
26.4

27.4
30.2
32.3
38.0

[0137] In some embodiments, Compound **1** crystalline form Type G is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
5.36	16.48
8.73	10.13
12.83	6.90
14.34	6.18
15.00	5.91
15.79	5.61
16.58	5.35
18.54	4.79
19.78	4.49
21.35	4.16
22.35	3.98
23.38	3.80
25.33	3.52
26.43	3.37
27.35	3.26
30.21	2.96
32.32	2.77
38.04	2.37

[0138] In some embodiments, Compound **1** crystalline form Type G is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
5.4	16.5
8.7	10.1
12.8	6.9
14.3	6.2
15.0	5.9

2 theta	d-spacing
15.8	5.6
16.6	5.3
18.6	4.8
19.8	4.5
21.3	4.2
22.3	4.0
23.4	3.8
25.3	3.5
26.4	3.4
27.4	3.3
30.2	3.0
32.3	2.8
38.0	2.4

Compound 1 Crystalline Form Type H

[0139] A novel Compound **1** crystalline form Type H can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.8, 14.7, 16.6, 20.0, 21.3, and 25.4. In some embodiments, Compound **1** crystalline form Type H can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.8, 14.7, 16.6, 20.0, 21.3, and 25.4, corresponding to d-spacing (angstroms ± 0.2) of 15.3, 6.0, 5.4, 4.4, 4.2, and 3.5, respectively.

[0140] In some embodiments, Compound **1** crystalline form Type H is characterized by an X-ray Powder Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

5.8
8.4
11.5
12.4
13.1
13.7
14.7
14.9
16.0
16.2
16.6
16.9
17.3
17.7

18.3
19.5
20.0
21.3
21.9
23.1
23.6
23.9
24.4
24.9
25.1
25.4
26.2
27.4
28.1
28.4
29.3
29.7
30.4
31.0
32.7
33.4
34.1
34.8
35.5
35.8
36.4
37.1
38.5

[0141] In some embodiments, Compound 1 crystalline form Type H is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
5.8	15.3
8.4	10.5
11.5	7.7
12.4	7.2
13.1	6.8
13.7	6.5
14.7	6.0

Pos. [°2Th.]	d-spacing [Å]
14.9	5.9
16.0	5.6
16.2	5.5
16.6	5.4
16.9	5.3
17.3	5.1
17.7	5.0
18.3	4.8
19.5	4.6
20.0	4.4
21.3	4.2
21.9	4.1
23.1	3.9
23.6	3.8
23.9	3.7
24.4	3.7
24.9	3.6
25.1	3.5
25.4	3.5
26.2	3.4
27.4	3.3
28.1	3.2
28.4	3.1
29.3	3.0
29.7	3.0
30.4	2.9
31.0	2.9
32.7	2.7
33.4	2.7
34.1	2.6
34.8	2.6
35.5	2.5
35.8	2.5
36.4	2.5
37.1	2.4
38.5	2.3

Compound 1 Crystalline Form Type I

[0142] A novel Compound **1** crystalline form Type I can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$)

of 5.2, 14.6, 15.5, 20.2, and 21.1. In some embodiments, Compound 1 crystalline form Type I can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.2, 14.6, 15.5, 20.2, and 21.1, corresponding to d-spacing (angstroms ± 0.2) of 17.1, 6.1, 5.7, 4.4, and 4.2, respectively.

[0143] In some embodiments, Compound 1 crystalline form Type I is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

5.2
8.8
10.3
12.6
14.6
15.5
16.1
16.3
16.6
17.1
17.6
18.7
18.9
20.2
20.5
20.7
21.1
21.5
22.0
22.3
23.7
24.8
25.2
26.0
26.3
26.5
26.8
27.0
27.5
27.7
28.1
29.6
30.0
30.4

31.3
32.0
32.5
33.2
34.0
34.6
36.9
38.2
38.9
39.5

[0144] In some embodiments, Compound **1** crystalline form Type I is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
5.2	17.1
8.8	10.1
10.3	8.6
12.6	7.0
14.6	6.1
15.5	5.7
16.1	5.5
16.3	5.4
16.6	5.3
17.1	5.2
17.6	5.0
18.7	4.7
18.9	4.7
20.2	4.4
20.5	4.3
20.7	4.3
21.1	4.2
21.5	4.1
22.0	4.0
22.3	4.0
23.7	3.8
24.8	3.6
25.2	3.5
26.0	3.4
26.3	3.4
26.5	3.4

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
26.8	3.3
27.0	3.3
27.5	3.2
27.7	3.2
28.1	3.2
29.6	3.0
30.0	3.0
30.4	2.9
31.3	2.9
32.0	2.8
32.5	2.8
33.2	2.7
34.0	2.6
34.6	2.6
36.9	2.4
38.2	2.4
38.9	2.3
39.5	2.3

Compound 1 Crystalline Form Type J

[0145] A novel Compound **1** crystalline form Type J can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.7, 22.8, 23.1, and 24.5. In some embodiments, Compound **1** crystalline form Type J can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.7, 22.8, 23.1, and 24.5, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 15.4, 3.9, 3.8, and 3.6, respectively.

[0146] In some embodiments, Compound **1** crystalline form Type J is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.5
5.7
7.1
7.7
9.1
10.5
11.2
11.7
12.3
12.9

14.3
14.5
15.4
15.7
16.3
17.3
18.3
18.7
19.3
19.6
20.5
21.2
21.5
22.8
23.1
23.6
24.1
24.5
25.2
25.9
26.4
27.8
29.3
36.2
37.0

[0147] In some embodiments, Compound 1 crystalline form Type J is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
4.5	19.5
5.7	15.4
7.1	12.7
7.7	11.5
9.1	9.7
10.5	8.4
11.2	7.9
11.7	7.5
12.3	7.2
12.9	6.8
14.3	6.2

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
14.5	6.1
15.4	5.8
15.7	5.7
16.3	5.4
17.3	5.1
18.3	4.9
18.7	4.7
19.3	4.6
19.6	4.5
20.5	4.3
21.2	4.2
21.5	4.1
22.8	3.9
23.1	3.8
23.6	3.8
24.1	3.7
24.5	3.6
25.2	3.5
25.9	3.4
26.4	3.4
27.8	3.2
29.3	3.0
36.2	2.5
37.0	2.4

Compound 1 Crystalline Form Type K

[0148] A novel Compound **1** crystalline form Type K can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.4, 15.6, 16.1, 23.2, and 27.4. In some embodiments, Compound **1** crystalline form Type K can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.4, 15.6, 16.1, 23.2, and 27.4, corresponding to d-spacing (angstroms ± 0.2) of 19.2, 5.7, 5.7, 5.5, 3.8, and 3.3, respectively.

[0149] In some embodiments, Compound **1** crystalline form Type K is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.6
9.3
10.1
12.9

13.9
14.7
15.4
15.6
16.1
17.8
18.3
18.6
19.3
20.0
20.7
21.6
21.9
22.9
23.2
24.4
25.0
25.5
26.0
27.4
28.8
29.2
30.7
31.1
32.7
36.3

[0150] In some embodiments, Compound **1** crystalline form Type K is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
4.6	19.2
9.3	9.5
10.1	8.7
12.9	6.8
13.9	6.4
14.7	6.0
15.4	5.7
15.6	5.7
16.1	5.5
17.8	5.0

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
18.3	4.9
18.6	4.8
19.3	4.6
20.0	4.4
20.7	4.3
21.6	4.1
21.9	4.1
22.9	3.9
23.2	3.8
24.4	3.6
25.0	3.6
25.5	3.5
26.0	3.4
27.4	3.3
28.8	3.1
29.2	3.1
30.7	2.9
31.1	2.9
32.7	2.7
36.3	2.5

Compound 1 Crystalline Form Type L

[0151] A novel Compound **1** crystalline form Type L can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.9, 11.9, 17.8, 21.6, 23.9, and 36.1. In some embodiments, Compound **1** crystalline form Type L can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 5.9, 11.9, 17.8, 21.6, 23.9, and 36.1, corresponding to d-spacing (angstroms ± 0.2) of 14.9, 7.5, 5.0, 4.1, 3.7, and 2.5, respectively.

[0152] In some embodiments, Compound **1** crystalline form Type L is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

5.9
8.4
11.9
13.3
14.7
15.0
16.2
16.7

16.9
 17.8
 18.9
 20.4
 21.2
 21.6
 22.2
 23.9
 24.6
 25.5
 25.7
 26.1
 26.8
 28.1
 28.8
 29.9
 30.6
 31.9
 32.4
 33.6
 34.2
 35.6
 36.1
 38.2

[0153] In some embodiments, Compound **1** crystalline form Type L is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
5.9	14.9
8.4	10.5
11.9	7.5
13.3	6.6
14.7	6.0
15.0	5.9
16.2	5.5
16.7	5.3
16.9	5.2
17.8	5.0
18.9	4.7
20.4	4.4

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
21.2	4.2
21.6	4.1
22.2	4.0
23.9	3.7
24.6	3.6
25.5	3.5
25.7	3.5
26.1	3.4
26.8	3.3
28.1	3.2
28.8	3.1
29.9	3.0
30.6	2.9
31.9	2.8
32.4	2.8
33.6	2.7
34.2	2.6
35.6	2.5
36.1	2.5
38.2	2.4

Compound 1 Crystalline Form Type M

[0154] A novel Compound 1 crystalline form Type M can be identified by an X-ray Powder Diffraction (XRPD) pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.8, 9.7, 15.6, 21.9, and 26.7. In some embodiments, Compound 1 crystalline form Type M can be identified by X-ray Powder Diffraction (XRPD), having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.8, 9.7, 15.6, 21.9, and 26.7, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 15.3, 9.1, 5.7, 4.1, and 3.3, respectively.

[0155] In some embodiments, Compound 1 crystalline form Type M is characterized by an X-ray Power Diffraction having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) of:

4.5
5.8
6.1
8.7
9.0
9.7
12.3
13.1

13.7
14.5
15.1
15.6
16.8
17.4
18.0
18.5
19.5
20.0
21.4
21.9
22.3
22.9
23.3
23.5
24.1
25.0
25.8
26.3
26.7
27.8
28.1
29.4
30.8
31.7
33.0
35.3
37.8
38.6

[0156] In some embodiments, Compound **1** crystalline form Type M is characterized by an X-ray Power Diffraction pattern having one or more characteristic diffractions at angles ($2\theta \pm 0.2$) and corresponding d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
4.5	19.5
5.8	15.3
6.1	14.4
8.7	10.2
9.0	9.9
9.7	9.1

Pos. [°2Th.]	d-spacing [Å]
12.3	7.2
13.1	6.8
13.7	6.4
14.5	6.1
15.1	5.9
15.6	5.7
16.8	5.3
17.4	5.1
18.0	4.9
18.5	4.8
19.5	4.5
20.0	4.4
21.4	4.1
21.9	4.1
22.3	4.0
22.9	3.9
23.3	3.8
23.5	3.8
24.1	3.7
25.0	3.6
25.8	3.5
26.3	3.4
26.7	3.3
27.8	3.2
28.1	3.2
29.4	3.0
30.8	2.9
31.7	2.8
33.0	2.7
35.3	2.5
37.8	2.4
38.6	2.3

Pharmaceutical Compositions Comprising Compound 1 Crystalline Form

[0157] In some embodiments, the present disclosure provides a pharmaceutical composition comprising a therapeutically effective amount of any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, or Type G) of Compound 1 as discussed above, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a

pharmaceutical composition comprising a therapeutically effective amount of any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, Type G, Type H, Type I, Type J, Type K, Type L, or Type M) of Compound 1 as discussed above, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a pharmaceutical composition comprising any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, or Type G) of Compound 1 as discussed above, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a pharmaceutical composition comprising any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, Type G, Type H, Type I, Type J, Type K, Type L, or Type M) of Compound 1 as discussed above, and one or more pharmaceutically acceptable excipients. In some embodiments, the pharmaceutical composition is for oral administration.

[0158] In some embodiments, the present disclosure provides a pharmaceutical composition comprising any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, or Type G) of Compound 1 as discussed above, and having a water content of about 0.5-5.0 weight%, preferably about 1.0-4.5 weight%, more preferably about 1.5-4.0 weight%, even more preferably about 2.0-3.5 weight%, still more preferably about 2.5-3.0 weight% relative to the weight of the pharmaceutical composition. In some embodiments, the present disclosure provides a pharmaceutical composition comprising any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, Type G, Type H, Type I, Type J, Type K, Type L, or Type M) of Compound 1 as discussed above, and having a water content of about 0.5-5.0 weight%, preferably about 1.0-4.5 weight%, more preferably about 1.5-4.0 weight%, even more preferably about 2.0-3.5 weight%, still more preferably about 2.5-3.0 weight% relative to the weight of the pharmaceutical composition. In some embodiments, the present disclosure provides a pharmaceutical composition comprising any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, or Type G) of Compound 1 as discussed above, and having a water content in an amount selected from the following ranges: about 0.5-1.0 weight%, about 1.0-1.5 weight%, about 1.5-2.0 weight%, about 2.5-3.0 weight%, about 3.0-3.5 weight%, about 3.5-4.0 weight%, about 4.0-4.5 weight%, and about 4.5-5.0 weight% relative to the weight of the pharmaceutical composition. In some embodiments, the present disclosure provides a pharmaceutical composition comprising any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, Type G, Type H, Type I, Type J, Type K, Type L, or Type M) of Compound 1 as discussed above, and having a water

content in an amount selected from the following ranges: about 0.5-1.0 weight%, about 1.0-1.5 weight%, about 1.5-2.0 weight%, about 2.5-3.0 weight%, about 3.0-3.5 weight%, about 3.5-4.0 weight%, about 4.0-4.5 weight%, and about 4.5-5.0 weight% relative to the weight of the pharmaceutical composition. In some embodiments, the present disclosure provides a pharmaceutical composition comprising any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, or Type G) of Compound 1 as discussed above, and having a water content in an amount selected from the weight percentage: about 0.5 weight%, about 1.0 weight%, about 1.5 weight%, about 2.0 weight%, about 2.5 weight%, about 3.0 weight%, about 3.5 weight%, about 4.0 weight%, about 4.5 weight%, and about 5.0 weight% relative to the weight of the pharmaceutical composition. In some embodiments, the present disclosure provides a pharmaceutical composition comprising any crystalline solid form (Type A, Type B, Type C, Type D, Type E, Type F, Type G, Type H, Type I, Type J, Type K, Type L, or Type M) of Compound 1 as discussed above, and having a water content in an amount selected from the weight percentage: about 0.5 weight%, about 1.0 weight%, about 1.5 weight%, about 2.0 weight%, about 2.5 weight%, about 3.0 weight%, about 3.5 weight%, about 4.0 weight%, about 4.5 weight%, and about 5.0 weight% relative to the weight of the pharmaceutical composition.

[0159] In some embodiments, the present disclosure provides a pharmaceutical composition comprising a therapeutically effective amount of Compound 1 crystalline form Type A, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a pharmaceutical composition comprising Compound 1 crystalline form Type A, and one or more pharmaceutically acceptable excipients. In some embodiments, the pharmaceutical composition is for oral administration. In some embodiments, the pharmaceutical composition is substantially free of other crystalline forms of Compound 1. In some embodiments, the pharmaceutical composition is substantially free of amorphous Compound 1.

[0160] In some embodiments, the present disclosure provides a pharmaceutical composition comprising a therapeutically effective amount of Compound 1 crystalline form Type B, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a pharmaceutical composition comprising Compound 1 crystalline form Type B, and one or more pharmaceutically acceptable excipients. In some embodiments, the pharmaceutical composition is for oral administration. In some embodiments, the pharmaceutical composition is

substantially free of other crystalline forms of Compound 1. In some embodiments, the pharmaceutical composition is substantially free of amorphous Compound 1.

[0161] In some embodiments, the present disclosure provides a pharmaceutical composition comprising a therapeutically effective amount of Compound 1 crystalline form Type C, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a pharmaceutical composition comprising Compound 1 crystalline form Type C, and one or more pharmaceutically acceptable excipients. In some embodiments, the pharmaceutical composition is for oral administration. In some embodiments, the pharmaceutical composition is substantially free of other crystalline forms of Compound 1. In some embodiments, the pharmaceutical composition is substantially free of amorphous Compound 1.

[0162] In some embodiments, the present disclosure provides a pharmaceutical composition comprising a therapeutically effective amount of Compound 1 crystalline form Type D, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a pharmaceutical composition comprising Compound 1 crystalline form Type D, and one or more pharmaceutically acceptable excipients. In some embodiments, the pharmaceutical composition is for oral administration. In some embodiments, the pharmaceutical composition is substantially free of other crystalline forms of Compound 1. In some embodiments, the pharmaceutical composition is substantially free of amorphous Compound 1.

[0163] In some embodiments, the present disclosure provides a pharmaceutical composition comprising a therapeutically effective amount of Compound 1 crystalline form Type E, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a pharmaceutical composition comprising Compound 1 crystalline form Type E, and one or more pharmaceutically acceptable excipients. In some embodiments, the pharmaceutical composition is for oral administration. In some embodiments, the pharmaceutical composition is substantially free of other crystalline forms of Compound 1. In some embodiments, the pharmaceutical composition is substantially free of amorphous Compound 1.

[0164] In some embodiments, the present disclosure provides a pharmaceutical composition comprising a therapeutically effective amount of Compound 1 crystalline form Type F, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a pharmaceutical composition comprising Compound 1 crystalline form Type F, and one or more pharmaceutically acceptable excipients. In some embodiments, the pharmaceutical

composition is for oral administration. In some embodiments, the pharmaceutical composition is substantially free of other crystalline forms of Compound 1. In some embodiments, the pharmaceutical composition is substantially free of amorphous Compound 1.

[0165] In some embodiments, the present disclosure provides a pharmaceutical composition comprising a therapeutically effective amount of Compound 1 crystalline form Type G, and one or more pharmaceutically acceptable excipients. In some embodiments, the present disclosure provides a pharmaceutical composition comprising Compound 1 crystalline form Type G, and one or more pharmaceutically acceptable excipients. In some embodiments, the pharmaceutical composition is for oral administration. In some embodiments, the pharmaceutical composition is substantially free of other crystalline forms of Compound 1. In some embodiments, the pharmaceutical composition is substantially free of amorphous Compound 1.

[0166] In some embodiments, the present disclosure provides a pharmaceutical composition comprising a crystalline form of Compound 1. In some embodiments, a pharmaceutical composition comprises a crystalline form of Compound 1 and an amorphous form of Compound 1, wherein the amorphous form of Compound 1 is present in an amount selected from the following ranges: about 90 to about 99%, about 80 to about 89%, about 70 to about 79%, about 60 to about 69%, about 50 to about 59%, about 40 to about 49%, about 30 to about 39%, about 20 to about 29%, about 10 to about 19%, about 1 to about 9% and about 0 to about 0.99%. In some embodiments, a pharmaceutical composition comprising a crystalline form of Compound 1 is substantially free of amorphous Compound 1.

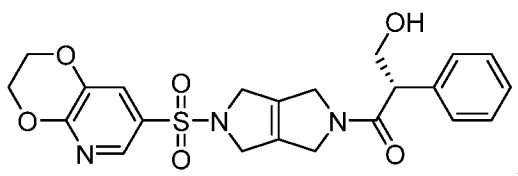
[0167] In some embodiments, the present disclosure provides a pharmaceutical composition comprising Compound 1 and its enantiomer ("Compound 2"). In some embodiments, a pharmaceutical composition comprises Compound 1 and its enantiomer Compound 2, wherein Compound 1 has an enantiomeric excess selected from the following ranges: at least about 99%, at least about 95%, at least about 90%, at least about 80%, about 90 to about 99%, about 80 to about 89%, about 70 to about 79%, about 60 to about 69%, about 50 to about 59%, about 40 to about 49%, about 30 to about 39%, about 20 to about 29%, about 10 to about 19%, about 1 to about 9% and about 0 to about 0.99%. In some embodiments, a pharmaceutical composition comprises Compound 1 and its enantiomer Compound 2, wherein the weight percentage of Compound 1 relative to the total weight of Compound 1 and Compound 2 is in a percentage selected from the following ranges: about 90 to about 99%, about 80 to about 89%, about 70 to

about 79%, about 60 to about 69%, about 50 to about 59%, about 40 to about 49%, about 30 to about 39%, about 20 to about 29%, about 10 to about 19%, about 1 to about 9% and about 0 to about 0.99%.

[0168] Pharmaceutical compositions described herein can comprise a pharmaceutically acceptable carrier or one or more excipients. In some embodiments, pharmaceutical compositions described herein can be provided in a unit dosage form container (e.g., in a vial or bag, or the like). In some embodiments, pharmaceutical compositions described herein can be provided in an oral dosage form. In some embodiments, an oral dosage form is a tablet.

Amorphous Solid Dispersion Comprising Compound 1

[0169] The present disclosure also provides an amorphous solid dispersion comprising Compound 1:



and a polymer. In some embodiments, the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof. In some embodiments, the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS). In some embodiments, the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS), including any grade thereof (e.g., HPMC AS MG).

[0170] Various amounts of Compound 1 and the polymer can be used in the amorphous solid dispersion. In some embodiments, the weight ratio of Compound 1 to the polymer in the

amorphous solid dispersion can be selected from the following ranges: about 10:1, about 9:1, about 8:1, about 7:1, about 6:1, about 5:1, about 4:1, about 3:1, about 2:1, about 1:1, about 1:2, about 1:3, about 1:4, about 1:5, about 1:6, about 1:7, about 1:8, about 1:9, and about 1:10. In some embodiments, the weight ratio of Compound 1 to the polymer in the amorphous solid dispersion is in a range of about 3:1 to about 1:3. In some embodiments, the weight ratio of Compound 1 to the polymer in the amorphous solid dispersion is in a range of about 2:1 to about 1:3. In some embodiments, the weight ratio of Compound 1 to the polymer in the amorphous solid dispersion is about 1:3. In some embodiments, the weight ratio of Compound 1 to the polymer in the amorphous solid dispersion is about 1:1. In some embodiments, the weight ratio of Compound 1 to the polymer in the amorphous solid dispersion is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1. In some embodiments, the weight ratio of Compound 1 to the polymer in the amorphous solid dispersion is about 1:3, about 2:3, about 1:1, about 1.5:1, or about 2:1.

[0171] In some embodiments, the amorphous solid dispersion is free or substantially free of crystalline Compound 1. In some embodiments, crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion. In some embodiments, crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion. In some embodiments, a single glass transition temperature (T_G) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion.

[0172] In some embodiments, the amorphous solid dispersion is physically stable in that it remains free or substantially free of crystalline Compound 1 over time in accelerated stability studies. In some embodiments, crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in a container as described in Example 20 for 5 months at 2-8 °C and ambient relative humidity, 5 months at 25 °C and 60 % relative humidity, 1 month at 2-8 °C and ambient relative humidity, 1 month at 25 °C and 60 % relative humidity, or 1 month at 40 °C and 75 % relative humidity. In some embodiments, a single glass transition temperature (T_G) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in a container as described in Example 20 for 5 months at 2-8 °C and ambient relative humidity, 5 months at 25 °C and 60 % relative humidity, 1 month at 2-8 °C and ambient relative humidity, 1 month at 25 °C and 60 % relative humidity, or 1 month at 40 °C and 75 % relative humidity. In some embodiments,

crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in a sealed vial for 1 week at 60 °C, storage in a sealed vial for 2 weeks at 60 °C, storage in an unsealed vial for 1 week at 25 °C and 60% relative humidity, storage in an unsealed vial for 2 weeks at 25 °C and 60% relative humidity, storage in an unsealed vial for 1 week at 40 °C and 75% relative humidity, storage in an unsealed vial for 2 weeks at 40 °C and 75% relative humidity, storage in an unsealed vial for 1 week at 60 °C and 75% relative humidity, or storage in an unsealed vial for 2 weeks at 60 °C and 75% relative humidity. In some embodiments, a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in a sealed vial for 1 week at 60 °C, storage in a sealed vial for 2 weeks at 60 °C, storage in an unsealed vial for 1 week at 25 °C and 60% relative humidity, storage in an unsealed vial for 2 weeks at 25 °C and 60% relative humidity, storage in an unsealed vial for 1 week at 40 °C and 75% relative humidity, storage in an unsealed vial for 2 weeks at 40 °C and 75% relative humidity, storage in an unsealed vial for 1 week at 60 °C and 75% relative humidity, or storage in an unsealed vial for 2 weeks at 60 °C and 75% relative humidity.

[0173] In some embodiments, the amorphous solid dispersion is highly soluble, e.g., Compound 1 dissolves quickly and readily in biorelevant media. In some embodiments, Compound 1 has a concentration of at least 150 µg/mL, at least 200 µg/mL, at least 250 µg/mL, at least 300 µg/mL, or at least 350 µg/mL after 30 minutes in the kinetic solubility experiment described in Example 23. In some embodiments, Compound 1 has a C_{max} of at least 300 µg/mL, at least 350 µg/mL, at least 400 µg/mL, at least 450 µg/mL, at least 500 µg/mL, at least 550 µg/mL, at least 600 µg/mL, at least 650 µg/mL, or at least 700 µg/mL in the kinetic solubility experiment described in Example 23. In some embodiments, Compound 1 has a concentration of at least 200 µg/mL, at least 250 µg/mL, at least 300 µg/mL, at least 350 µg/mL, at least 400 µg/mL, at least 450 µg/mL, at least 500 µg/mL, at least 550 µg/mL, or at least 600 µg/mL after 4 hours in the kinetic solubility experiment described in Example 23. In some embodiments, Compound 1 has a concentration of at least 150 µg/mL, at least 200 µg/mL, at least 250 µg/mL, or at least 300 µg/mL after 16 hours in the kinetic solubility experiment described in Example 23.

Pharmaceutical Compositions Comprising Compound 1 Amorphous Solid Dispersion

[0174] The present disclosure further provides a pharmaceutical composition comprising a therapeutically effective amount of an amorphous solid dispersion comprising Compound **1**, and one or more pharmaceutically acceptable excipients. In some embodiments, the pharmaceutical composition is for oral administration.

[0175] In some embodiments, the present disclosure provides a pharmaceutical composition comprising an amorphous solid dispersion comprising Compound **1**, and having a water content of about 0.5-5.0 weight%, preferably about 1.0-4.5 weight%, more preferably about 1.5-4.0 weight%, even more preferably about 2.0-3.5 weight%, still more preferably about 2.5-3.0 weight% relative to the weight of the pharmaceutical composition. In some embodiments, the present disclosure provides a pharmaceutical composition comprising an amorphous solid dispersion comprising Compound **1**, and having a water content in an amount selected from the following ranges: about 0.5-1.0 weight%, about 1.0-1.5 weight%, about 1.5-2.0 weight%, about 2.5-3.0 weight%, about 3.0-3.5 weight%, about 3.5-4.0 weight%, about 4.0-4.5 weight%, and about 4.5-5.0 weight% relative to the weight of the pharmaceutical composition. In some embodiments, the present disclosure provides a pharmaceutical composition comprising an amorphous solid dispersion comprising Compound **1**, and having a water content in an amount selected from the weight percentage: about 0.5 weight%, about 1.0 weight%, about 1.5 weight%, about 2.0 weight%, about 2.5 weight%, about 3.0 weight%, about 3.5 weight%, about 4.0 weight%, about 4.5 weight%, and about 5.0 weight% relative to the weight of the pharmaceutical composition.

[0176] In some embodiments, the pharmaceutical composition comprises about 10 mg, about 25 mg, about 50 mg, about 100 mg, about 200 mg, or about 300 mg of Compound **1**. In some embodiments, the pharmaceutical composition comprises about 25 mg of Compound **1**. In some embodiments, the pharmaceutical composition comprises about 100 mg of Compound **1**. In some embodiments, the pharmaceutical composition comprises about 200 mg of Compound **1**.

[0177] Pharmaceutical compositions described herein can comprise a pharmaceutically acceptable carrier or one or more excipients. In some embodiments, pharmaceutical compositions described herein can be provided in a unit dosage form container (e.g., in a vial or bag, or the like). In some embodiments, pharmaceutical compositions described herein can be provided in an oral dosage form. In some embodiments, an oral dosage form is a tablet.

[0178] In some embodiments, the pharmaceutical composition comprises one or more pharmaceutically acceptable excipients which comprise one or more of a filler, a dry binder, a glidant, a lubricant, a disintegrant, and a film coating agent. In some embodiments, the one or more pharmaceutically acceptable excipients comprise a filler, and the filler comprises microcrystalline cellulose. In some embodiments, the one or more pharmaceutically acceptable excipients comprise a filler, and the filler comprises lactose monohydrate. In some embodiments, the one or more pharmaceutically acceptable excipients comprise a dry binder, and the dry binder comprises croscopolvidone. In some embodiments, the one or more pharmaceutically acceptable excipients comprise a glidant, and the glidant comprises colloidal silicon dioxide. In some embodiments, the one or more pharmaceutically acceptable excipients comprise a lubricant, and the lubricant comprises magnesium stearate. In some embodiments, the one or more pharmaceutically acceptable excipients comprise a disintegrant, and the disintegrant comprises croscarmellose sodium. In some embodiments, the one or more pharmaceutically acceptable excipients comprise a lubricant, and the lubricant comprises magnesium stearate.

[0179] In some embodiments, a pharmaceutical composition comprises a tablet core. In some embodiments, the tablet core comprises an intra granular portion comprising the amorphous solid dispersion, and an extra granular portion blended with the intra granular portion. In some embodiments, a pharmaceutical composition further comprises a coating disposed on the tablet core.

[0180] Various amounts of Compound **1** relative to the tablet core can be used in a pharmaceutical composition comprising an amorphous solid dispersion comprising Compound **1**. In some embodiments, the amorphous solid dispersion comprising Compound **1** can be about 10 weight%, about 20 weight%, about 30 weight%, about 40 weight%, about 50 weight%, about 60 weight%, about 70 weight%, about 80 weight%, or about 90 weight% of the tablet core. In some embodiments, the amorphous solid dispersion comprising Compound **1** is at least about 30 weight% of the tablet core. In some embodiments, the amorphous solid dispersion comprising Compound **1** is at least about 50 weight% of the tablet core. In some embodiments, the amorphous solid dispersion comprising Compound **1** is at least about 60 weight% of the tablet core. In some embodiments, the amorphous solid dispersion comprising Compound **1** is about 50 weight% of the tablet core. In some embodiments, the amorphous solid dispersion comprising

Compound **1** is about 50 to about 70 weight% of the tablet core. In some embodiments, the amorphous solid dispersion comprising Compound **1** is about 60 to about 65 weight% of the tablet core.

[0181] In some embodiments, the intra granular portion further comprises one or more of a filler, a dry binder, a glidant, and a lubricant. In some embodiments, the extra granular portion further comprises one or more of a filler, a disintegrant, and a lubricant.

[0182] In some embodiments, the tablet core has the following components:

Function	% Formulation (weight)	Exemplary Component
API	30-70%	Amorphous Solid Dispersion of Compound 1
Filler	15-40%	Microcrystalline Cellulose
Dry binder	2-10%	Crospovidone
Glidant	0.25-1.25%	Colloidal Silicon Dioxide
Lubricant	0.25-1.00%	Magnesium Stearate

[0183] In some embodiments, the tablet core has the following components:

Function	% Formulation (weight)	Exemplary Component
API	30-70%	Amorphous Solid Dispersion of Compound 1
Filler	15-50%	Microcrystalline Cellulose, Lactose Monohydrate
Dry binder	2-10%	Crospovidone
Glidant	0.25-1.25%	Colloidal Silicon Dioxide
Disintegrant	2-3%	Croscarmellose Sodium
Lubricant	0.25-1.00%	Magnesium Stearate

[0184] In some embodiments, the tablet core has the following components:

Component	Function	Range
SDD (1:1 drug:polymer w/w)	Active	50-75%
Microcrystalline Cellulose	Filler	15-30%
Lactose Monohydrate	Filler	0-20%
Crosslinked polyvinylpyrrolidone	Dry Binder	2-10%
Colloidal Silicon Dioxide	Glidant	<2%
Croscarmellose Sodium	Disintegrant	2-10%
Magnesium Stearate	Lubricant	<2%

[0185] In some embodiments, the tablet core has the following components:

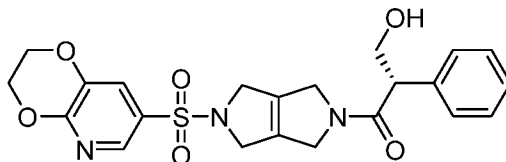
Component	Function	Range
SDD (1.5:1 drug:polymer w/w)	Active	50-75%
Microcrystalline Cellulose	Filler	15-30%
Lactose Monohydrate	Filler	0-20%
Crosslinked polyvinylpyrrolidone	Dry Binder	2-10%
Colloidal Silicon Dioxide	Glidant	<2%
Croscarmellose Sodium	Disintegrant	2-10%
Magnesium Stearate	Lubricant	<2%

[0186] In some embodiments, the Compound 1 oral unit dosage form can be a tablet comprising a total of about 10-35% by weight of Compound 1, with a total dose of about 100 mg or 200 mg, and a total weight of less than about 800 mg. In one embodiment, a tablet having a composition described in a table above comprises about 50% of an API formed as an amorphous solid dispersion of Compound 1 obtained from a 1:3 SDD process described in the examples below (e.g., about 12.5% of Compound 1 in the tablet). In one embodiment, a tablet having a

composition described in a table above comprises about 30% of an API formed as an amorphous solid dispersion of Compound 1 obtained from a 1:1 SDD process described in the examples below (e.g., about 15% of Compound 1 in the tablet, with a total of about 100 mg Compound 1 in the tablet). In one embodiment, a tablet having a composition described in a table above comprises about 62% of an API formed as an amorphous solid dispersion of Compound 1 obtained from a 1:1 SDD process described in the examples below (e.g., about 31% of Compound 1 in the tablet, with a total of about 200 mg of Compound 1 in the tablet)

Methods for Preparing Amorphous Solid Dispersions of Compound 1

[0187] The present disclosure also provides a method for preparing an amorphous solid dispersion comprising Compound 1:



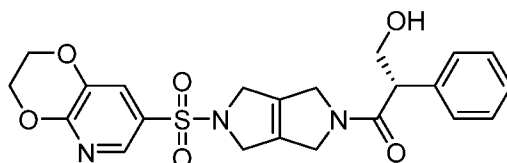
[0188] In some embodiments, the method comprises mixing Compound 1, a polymer, and a solvent to afford a mixture, and spray-drying the mixture to afford an amorphous solid dispersion comprising Compound 1.

[0189] In some embodiments, the polymer used in the method is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof. In some embodiments, the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS). In some embodiments, the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS), including any grade thereof (e.g., HPMC AS MG).

[0190] Various amounts of Compound **1** and the polymer can be used in the method to prepare the amorphous solid dispersion. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion can be selected from the following ranges: about 10:1, about 9:1, about 8:1, about 7:1, about 6:1, about 5:1, about 4:1, about 3:1, about 2:1, about 1:1, about 1:2, about 1:3, about 1:4, about 1:5, about 1:6, about 1:7, about 1:8, about 1:9, and about 1:10. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is in a range of about 3:1 to about 1:3. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is in a range of about 2:1 to about 1:3. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is about 1:3. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is about 1:1. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is about 1:3, about 2:3, about 1:1, about 1.5:1, or about 2:1.

[0191] Various solvents can be used in the method to prepare the amorphous solid dispersion. In some embodiments, the solvent is dichloromethane and methanol.

[0192] The present disclosure further provides a product prepared by a process comprising mixing Compound **1**, a polymer, and a solvent to afford a mixture, and spray-drying the mixture to afford an amorphous solid dispersion comprising Compound **1**



1.

[0193] In some embodiments, the polymer used in the process is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a

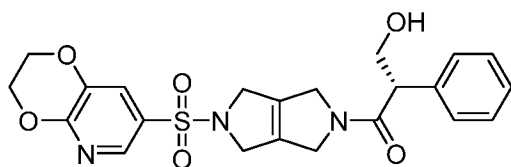
combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof. In some embodiments, the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS). In some embodiments, the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS), including any grade thereof (e.g., HPMC AS MG).

[0194] Various amounts of Compound **1** and the polymer can be used in the process to prepare the amorphous solid dispersion. In some embodiments, the weight ratio of Compound **1** to the polymer used in the process to prepare the amorphous solid dispersion can be selected from the following ranges: about 10:1, about 9:1, about 8:1, about 7:1, about 6:1, about 5:1, about 4:1, about 3:1, about 2:1, about 1:1, about 1:2, about 1:3, about 1:4, about 1:5, about 1:6, about 1:7, about 1:8, about 1:9, and about 1:10. In some embodiments, the weight ratio of Compound **1** to the polymer used in the process to prepare the amorphous solid dispersion is in a range of about 3:1 to about 1:3. In some embodiments, the weight ratio of Compound **1** to the polymer used in the process to prepare the amorphous solid dispersion is in a range of about 2:1 to about 1:3. In some embodiments, the weight ratio of Compound **1** to the polymer used in the process to prepare the amorphous solid dispersion is about 1:3. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is about 1:1. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is about 1:3, about 2:3, about 1:1, about 1.5:1, or about 2:1.

[0195] Various solvents can be used in the process to prepare the amorphous solid dispersion. In some embodiments, the solvent is dichloromethane and methanol.

Pharmaceutical Compositions Comprising Compound 1

[0196] The present disclosure provides a pharmaceutical composition comprising Compound **1**:



obtained by a process comprising mixing Compound **1** in a solid form, a polymer, and a solvent to afford a mixture, and spray-drying the mixture to afford an amorphous solid dispersion comprising Compound **1**.

[0197] In some embodiments, the solid form is Type A of Compound **1**. In some embodiments, the solid form is Type B of Compound **1**. In some embodiments, the solid form is Type C of Compound **1**. In some embodiments, the solid form is Type D of Compound **1**. In some embodiments, the solid form is Type E of Compound **1**. In some embodiments, the solid form is Type F of Compound **1**. In some embodiments, the solid form is Type G of Compound **1**. In some embodiments, the solid form is Type H of Compound **1**. In some embodiments, the solid form is Type I of Compound **1**. In some embodiments, the solid form is Type J of Compound **1**. In some embodiments, the solid form is Type K of Compound **1**. In some embodiments, the solid form is Type L of Compound **1**. In some embodiments, the solid form is Type M of Compound **1**. In some embodiments, the solid form is selected from the group consisting of Type A, Type B, Type C, Type D, Type E, Type F, Type G, Type H, Type I, Type J, Type K, Type L, and Type M of Compound **1**. In some embodiments, the solid form is amorphous form of Compound **1**.

[0198] In some embodiments, the pharmaceutical composition obtained by the process has a water content of about 0.5-5.0 weight%, preferably about 1.0-4.5 weight%, more preferably about 1.5-4.0 weight%, even more preferably about 2.0-3.5 weight%, still more preferably about 2.5-3.0 weight% relative to the weight of the pharmaceutical composition. In some embodiments, the pharmaceutical composition obtained by the process has a water content in an amount selected from the following ranges: about 0.5-1.0 weight%, about 1.0-1.5 weight%, about 1.5-2.0 weight%, about 2.5-3.0 weight%, about 3.0-3.5 weight%, about 3.5-4.0 weight%, about 4.0-4.5 weight%, and about 4.5-5.0 weight% relative to the weight of the pharmaceutical composition. In some embodiments, the pharmaceutical composition obtained by the process has a water content in an amount selected from the weight percentage: about 0.5 weight%, about 1.0 weight%, about 1.5 weight%, about 2.0 weight%, about 2.5 weight%, about 3.0 weight%, about 3.5 weight%, about

4.0 weight%, about 4.5 weight%, and about 5.0 weight% relative to the weight of the pharmaceutical composition.

[0199] In some embodiments, the polymer used in the process is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof. In some embodiments, the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS). In some embodiments, the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS), including any grade thereof (e.g., HPMC AS MG).

[0200] Various amounts of Compound **1** and the polymer can be used in the process to prepare the amorphous solid dispersion. In some embodiments, the weight ratio of Compound **1** to the polymer used in the process to prepare the amorphous solid dispersion can be selected from the following ranges: about 10:1, about 9:1, about 8:1, about 7:1, about 6:1, about 5:1, about 4:1, about 3:1, about 2:1, about 1:1, about 1:2, about 1:3, about 1:4, about 1:5, about 1:6, about 1:7, about 1:8, about 1:9, and about 1:10. In some embodiments, the weight ratio of Compound **1** to the polymer used in the process to prepare the amorphous solid dispersion is in a range of about 3:1 to about 1:3. In some embodiments, the weight ratio of Compound **1** to the polymer used in the process to prepare the amorphous solid dispersion is in a range of about 2:1 to about 1:3. In some embodiments, the weight ratio of Compound **1** to the polymer used in the process to prepare the amorphous solid dispersion is about 1:3. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is about 1:1. In some embodiments, the weight ratio of Compound **1** to the polymer used in the method to prepare the amorphous solid dispersion is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1. In some embodiments, the weight ratio of Compound **1** to

the polymer used in the method to prepare the amorphous solid dispersion is about 1:3, about 2:3, about 1:1, about 1.5:1, or about 2:1.

[0201] Various solvents can be used in the process to prepare the amorphous solid dispersion. In some embodiments, the solvent is dichloromethane and methanol.

Solid Oral Dosage Forms of Compound 1

[0202] The disclosure also provides solid oral dosage forms of Compound 1, such as tablets and capsules. In some embodiments, the solid oral dosage form comprises a stabilized amorphous compound (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one, wherein the stabilized amorphous compound does not show crystallinity by PXRD (Method D) after 2 weeks of storage at 60 °C/75% RH (exposed). In some embodiments, the stabilized amorphous compound shows a single glass transition temperature (T_G) and no melt endotherm by DSC (Method B) after 2 weeks of storage at 60 °C/75% RH (exposed).

[0203] In some embodiments, the solid oral dosage form contains a total of about 100 mg or about 200 mg of (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one. In some embodiments, the solid dosage form has a total weight of not more than 700 mg, 800 mg, 900 mg, 1000 mg or 1200 mg. In some embodiments, the solid oral dosage form is a tablet or capsule.

[0204] In some embodiments, the stabilized amorphous compound in the solid oral dosage form is in a spray dried dispersion with a polymer. In some embodiments, the polymer is selected from the group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof. In some embodiments, the polymer is HPMC AS. In some embodiments, the (S)-1-(5-[2H,3H-

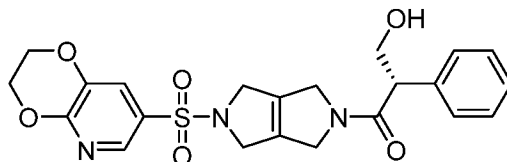
[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one is spray dried with HPMC AS in a weight ratio of 1:3 to 2:1. In some embodiments, the (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one is spray dried with HPMC AS in a weight ratio of 1:1.

[0205] The disclosure also relates to a (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one active pharmaceutical ingredient (API) composition comprising 0.05-5.0% by HPLC of (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one.

[0206] The disclosure also relates to a tablet comprising about 100 mg or about 200 mg of stabilized amorphous compound (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one as the active pharmaceutical ingredient (API), wherein the stabilized amorphous compound does not show crystallinity by PXRD (Method D) after 2 weeks of storage of the tablet at 60 °C/75% RH (exposed). In some embodiments, the API comprises less than 5.0% by HPLC of (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one. In some embodiments, the API comprises less than 0.05% by HPLC of (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one. In some embodiments, the tablet has a total weight of less than 700 mg, 800 mg, 900 mg, 1000 mg or 1200 mg.

Tablet Dosage Forms of Compound 1

[0207] The disclosure also provides tablet dosage forms of Compound 1. In some embodiments, the tablet dosage form comprises a tablet core, the tablet core comprising at least 10 weight % of Compound 1 in amorphous form:

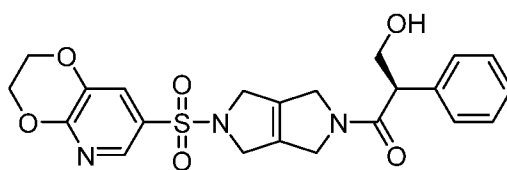


1,

wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core. In some embodiments, wherein the tablet core comprises at least 15 weight %, at least 20 weight %, at least 25 weight % or at least 30 weight % of Compound 1 in amorphous form. In some embodiments, the tablet core comprises about 200 mg of Compound 1 per tablet and has a total weight of no more than about 1200 mg, about 1100 mg, about 1000 mg, about 900 mg, about 800 mg, or about 700 mg per tablet per tablet.

[0208] In some embodiments, the tablet dosage form comprises a tablet core, the tablet core having a total weight of no more than about 1000 mg and comprising about 200 mg of Compound 1 in amorphous form per tablet, wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core. In some embodiments, the tablet core has a total weight of no more than about 800 mg per tablet.

[0209] In some embodiments, the tablet core comprises Compound 1 in highly enantiopure form. In some embodiments, the tablet core comprises 0.05-5.0 % of Compound 2:



2,

based on the total amount of Compound 1 and Compound 2. In some embodiments, the tablet core comprises 0.05-3.0 % of Compound 2, based on the total amount of Compound 1 and Compound 2. In some embodiments, the tablet core comprises 0.05-2.0 % of Compound 2, based on the total amount of Compound 1 and Compound 2. In some embodiments, the tablet core comprises 0.05-1.0 % of Compound 2, based on the total amount of Compound 1 and Compound 2.

[0210] In some embodiments, the tablet dosage form is physically stable in that it remains free or substantially free of crystalline Compound 1 over time in accelerated stability studies. In some embodiments, crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core after storage in a sealed container as described in Example 29 for 1 month at 25 °C and 60 % relative humidity, storage in a sealed container as described in Example 29 for 2 months at 25 °C and 60 % relative humidity, storage in a sealed container as described in Example 29 for 3 months at 25 °C and 60 % relative humidity, storage in a sealed

container as described in Example 29 for 1 month at 40 °C and 75 % relative humidity, storage in a sealed container as described in Example 29 for 2 months at 40 °C and 75 % relative humidity, storage in a sealed container as described in Example 29 for 3 months at 40 °C and 75 % relative humidity.

[0211] In some embodiments, Compound 1 is present in an amorphous solid dispersion comprising Compound 1 and a polymer. In some embodiments, the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof. In some embodiments, the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS). In some embodiments, the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS), including any grade thereof (e.g., HPMC AS MG).

[0212] In some embodiments, the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3. In some embodiments, the weight ratio of Compound 1 to the polymer is in a range of about 2:1 to about 1:3. In some embodiments, the weight ratio of Compound 1 to the polymer is about 1:3. In some embodiments, the weight ratio of Compound 1 to the polymer is about 1:1. In some embodiments, the weight ratio of Compound 1 to the polymer is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1. In some embodiments, the weight ratio of Compound 1 to the polymer is about 1:3, about 2:3, about 1:1, about 1.5:1, or about 2:1.

[0213] In some embodiments, the tablet core of the tablet dosage form further comprises one or more pharmaceutically acceptable excipients. In some embodiments, the one or more pharmaceutically acceptable excipients comprise one or more of a filler, a dry binder, a glidant, a lubricant, a disintegrant, and a film coating agent.

[0214] In some embodiments, the tablet core comprises an intra granular portion comprising Compound 1; and an extra granular portion blended with the intra granular portion. In some embodiments, the intragranular portion comprises an amorphous solid dispersion comprising Compound 1 and a polymer and one or more of a filler, a dry binder, a glidant, and a lubricant, and the extragranular portion comprises one or more of a filler, a disintegrant, and a lubricant. In some embodiments, the intragranular portion comprises:

- an amorphous solid dispersion of Compound 1 in an amount of 30-70 weight % of the tablet core;

- one or more fillers in an amount of 15-50 weight % of the tablet core;

- one or more dry binders in an amount of 2.50-10 weight % of the tablet core;

- one or more glidants in an amount of 0.50-1.50 weight % of the tablet core; and

- one or more lubricants in an amount of 0.25-1 weight % of the tablet core; and

the extragranular portion comprises:

- one or more fillers in an amount of 5-15 weight % of the tablet core;

- one or more disintegrants in an amount of 1.25-5 weight % of the tablet core; and

- one or more lubricants in an amount of 0.25-1 weight % of the tablet core.

[0215] In some embodiments, the tablet dosage form comprises:

- an amorphous solid dispersion of Compound 1 in an amount of 50-75 weight % of the tablet core;

- one or more fillers in an amount of 15-50 weight % of the tablet core;

- one or more dry binders in an amount of 2-10 weight % of the tablet core;

- one or more glidants in an amount of <2 weight % of the tablet core;

- one or more disintegrants in an amount of 2-10 weight % of the tablet core; and

- one or more lubricants in an amount of <2 weight % of the tablet core.

[0216] In some embodiments, the amorphous solid dispersion comprises Compound 1 and a polymer (as described in any of the embodiments set forth herein). In some embodiments, the one or more fillers comprise microcrystalline cellulose or lactose monohydrate. In some embodiments, the one or more dry binders comprise crospovidone or crosslinked polyvinylpyrrolidone. In some embodiments, the one or more glidants comprise colloidal silicon dioxide or fumed silica. In some embodiments, the one or more lubricants comprise magnesium stearate. In some embodiments, the one or more disintegrants comprise crocarmellose sodium.

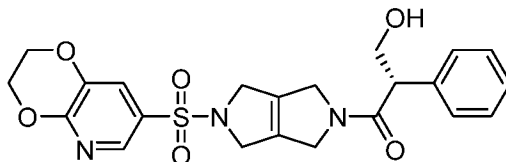
Medical Uses of the Solid Forms and Pharmaceutical Compositions

[0217] In some embodiments, the disclosure relates to a method of treating a disease associated with decreased activity of PKR in a subject in need thereof which comprises administering to the subject an effective amount of a compound of Formula I in any of the forms described herein, including any embodiment thereof.

Embodiments

[0218] In some embodiments, the disclosure relates to one or more of the following enumerated embodiments:

1. A crystalline solid form of Compound 1:



2. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type A of (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one ("Compound 1").
3. The crystalline solid form of embodiment 1 or 2, wherein Type A of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.61, 15.66, 23.19, and 24.76.
4. The crystalline solid form of any one of embodiments 1-3, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.61, 15.66, 23.19, and 24.76, corresponding to d-spacing (angstroms ± 0.2) of 19.19, 5.66, 3.84, and 3.60, respectively.

5. The crystalline solid form of any one of embodiments 1-4, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.61, 7.22, 15.66, 20.48, 21.35, 21.66, 22.47, 23.19, 24.76, and 26.73.

6. The crystalline solid form of any one of embodiments 1-5, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.61, 7.22, 15.66, 20.48, 21.35, 21.66, 22.47, 23.19, 24.76, and 26.73, corresponding to d-spacing (angstroms ± 0.2) of 19.19, 12.25, 5.66, 4.34, 4.16, 4.10, 3.96, 3.84, 3.60, and 3.34, respectively.

7. The crystalline solid form of any one of embodiments 1-6, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.61
5.80
7.22
7.68
11.21
12.31
14.44
15.66
16.95
18.02
19.20
20.48
21.35
21.66
22.47
23.19
24.76
26.73
28.01
28.49
29.35
30.25
32.14
34.12
36.46

8. The crystalline solid form of any one of embodiments 1-7, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.61	19.19
5.80	15.24
7.22	12.25
7.68	11.50
11.21	7.89
12.31	7.19
14.44	6.13
15.66	5.66
16.95	5.23
18.02	4.92
19.20	4.62
20.48	4.34
21.35	4.16
21.66	4.10
22.47	3.96
23.19	3.84
24.76	3.60
26.73	3.34
28.01	3.19
28.49	3.13
29.35	3.04
30.25	2.95
32.14	2.79
34.12	2.63
36.46	2.46

9. The crystalline solid form of any one of embodiments 1-8, wherein Type A of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 1.9% up to 100 °C.

10. The crystalline solid form of any one of embodiments 1-9, wherein Type A of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having a peak temperature of about 85.9 °C and an onset temperature of about 146.0 °C.

11. The crystalline solid form of any one of embodiments 1-10, wherein Type A of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 3.4% water uptake by weight up to 40% relative humidity.
12. The crystalline solid form of any one of embodiments 1-11, wherein Type A of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 1.0% water uptake by weight from 40% to 80% relative humidity.
13. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type B of Compound 1.
14. The crystalline solid form of embodiment 1 or 13, wherein Type B of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.52, 15.57, 22.89, 23.34, and 25.13.
15. The crystalline solid form of any one of embodiments 1 and 13-14, wherein Type B of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.52, 15.57, 22.89, 23.34, and 25.13, corresponding to d-spacing (angstroms ± 0.2) of 19.53, 5.69, 3.89, 3.81, and 3.54, respectively.
16. The crystalline solid form of any one of embodiments 1 and 13-15, wherein Type B of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.52, 9.86, 15.57, 19.93, 22.19, 22.89, 23.34, 25.13, and 28.30.
17. The crystalline solid form of any one of embodiments 1 and 13-16, wherein Type B of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.52, 9.86, 15.57, 19.93, 22.19, 22.89, 23.34, 25.13, and 28.30, corresponding to d-spacing (angstroms ± 0.2) of 19.53, 8.97, 5.69, 4.45, 4.00, 3.89, 3.81, 3.54, and 3.15, respectively.

18. The crystalline solid form of any one of embodiments 1 and 13-17, wherein Type B of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.52
8.98
9.86
12.37
13.18
15.57
16.86
18.21
19.11
19.93
20.92
22.19
22.89
23.34
25.13
25.80
26.71
28.30
29.39

19. The crystalline solid form of any one of embodiments 1 and 13-18, wherein Type B of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.52	19.53
8.98	9.85
9.86	8.97
12.37	7.15
13.18	6.72
15.57	5.69
16.86	5.26
18.21	4.87
19.11	4.64
19.93	4.45
20.92	4.25
22.19	4.00
22.89	3.89

2 theta	d-spacing
23.34	3.81
25.13	3.54
25.80	3.45
26.71	3.34
28.30	3.15
29.39	3.04

20. The crystalline solid form of any one of embodiments 1 and 13-19, wherein Type B of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 1.8% up to 100 °C.

21. The crystalline solid form of any one of embodiments 1 and 13-20, wherein Type B of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 2.3% up to 120 °C.

22. The crystalline solid form of any one of embodiments 1 and 13-21, wherein Type B of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having an onset temperature of about 138.2-139.2 °C.

23. The crystalline solid form of any one of embodiments 1 and 13-22, wherein Type B of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 2.9% water uptake by weight up to 60% relative humidity.

24. The crystalline solid form of any one of embodiments 1 and 13-23, wherein Type B of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 0.4% water uptake by weight from 60% to 80% relative humidity.

25. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type C of Compound 1.

26. The crystalline solid form of embodiment 1 or 25, wherein Type C of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.55, 18.85, 23.02, and 24.65.

27. The crystalline solid form of any one of embodiments 1 and 25-26, wherein Type C of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.55, 18.85, 23.02, and 24.65, corresponding to d-spacing (angstroms ± 0.2) of 19.43, 4.71, 3.86, and 3.61, respectively.

28. The crystalline solid form of any one of embodiments 1 and 25-27, wherein Type C of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.55, 7.34, 9.07, 11.17, 18.34, 18.85, 19.57, 21.66, 23.02, and 24.65.

29. The crystalline solid form of any one of embodiments 1 and 25-28, wherein Type C of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.55, 7.34, 9.07, 11.17, 18.34, 18.85, 19.57, 21.66, 23.02, and 24.65, corresponding to d-spacing (angstroms ± 0.2) of 19.43, 12.05, 9.75, 7.92, 4.84, 4.71, 4.54, 4.10, 3.86, and 3.61, respectively.

30. The crystalline solid form of any one of embodiments 1 and 25-29, wherein Type C of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.55
7.34
9.07
11.17
12.29
14.51
15.66
18.34
18.85
19.57
20.38
21.66
23.02
24.65
26.39

28.28
30.09
32.31
33.91
37.19

31. The crystalline solid form of any one of embodiments 1 and 25-30, wherein Type C of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.55	19.43
7.34	12.05
9.07	9.75
11.17	7.92
12.29	7.20
14.51	6.11
15.66	5.66
18.34	4.84
18.85	4.71
19.57	4.54
20.38	4.36
21.66	4.10
23.02	3.86
24.65	3.61
26.39	3.38
28.28	3.16
30.09	2.97
32.31	2.77
33.91	2.64
37.19	2.42

32. The crystalline solid form of any one of embodiments 1 and 25-31, wherein Type C of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 1.0% up to 100 °C.

33. The crystalline solid form of any one of embodiments 1 and 25-32, wherein Type C of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 2.3% up to 130 °C.
34. The crystalline solid form of any one of embodiments 1 and 25-33, wherein Type C of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having an onset temperature of about 152.2-154.2 °C.
35. The crystalline solid form of any one of embodiments 1 and 25-34, wherein Type C of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 1.8% water uptake by weight up to 60% relative humidity.
36. The crystalline solid form of any one of embodiments 1 and 25-35, wherein Type C of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 0.5% water uptake by weight from 60% to 80% relative humidity.
37. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type D of Compound 1.
38. The crystalline solid form of embodiment 1 or 37, wherein Type D of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 9.72, 13.08, 15.74, 21.90, and 23.59.
39. The crystalline solid form of any one of embodiments 1 and 37-38, wherein Type D of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 9.72, 13.08, 15.74, 21.90, and 23.59, corresponding to d-spacing (angstroms ± 0.2) of 9.10, 6.77, 5.63, 4.06 and 3.77, respectively.
40. The crystalline solid form of any one of embodiments 1 and 37-39, wherein Type D of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions

at angles ($2\theta \pm 0.2$) of 4.27, 6.15, 8.71, 9.72, 12.31, 13.08, 13.76, 15.74, 18.02, 21.90, 23.59, and 26.71.

41. The crystalline solid form of any one of embodiments 1 and 37-40, wherein Type D of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.27, 6.15, 8.71, 9.72, 12.31, 13.08, 13.76, 15.74, 18.02, 21.90, 23.59, and 26.71, corresponding to d-spacing (angstroms ± 0.2) of 20.68, 14.36, 10.16, 9.10, 7.19, 6.77, 6.44, 5.63, 4.92, 4.06, 3.77, and 3.34, respectively.

42. The crystalline solid form of any one of embodiments 1 and 37-41, wherein Type D of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.27
6.15
8.71
9.72
12.31
13.08
13.76
15.74
18.02
19.55
21.90
23.59
24.79
26.71
29.50
30.82
31.74
35.40
37.84
38.61

43. The crystalline solid form of any one of embodiments 1 and 37-42, wherein Type D of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.27	20.68
6.15	14.36
8.71	10.16
9.72	9.10
12.31	7.19
13.08	6.77
13.76	6.44
15.74	5.63
18.02	4.92
19.55	4.54
21.90	4.06
23.59	3.77
24.79	3.59
26.71	3.34
29.50	3.03
30.82	2.90
31.74	2.82
35.40	2.54
37.84	2.38
38.61	2.33

44. The crystalline solid form of any one of embodiments 1 and 37-43, wherein Type D of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 9.6% up to 130 °C.

45. The crystalline solid form of any one of embodiments 1 and 37-44, wherein Type D of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having an onset temperature of about 91.9 °C.

46. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type E of Compound 1.

47. The crystalline solid form of embodiment 1 or 46, wherein Type E of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles (2 theta $\pm$ 0.2) of 15.12, 15.75, 17.48, 20.05, 21.93, and 26.72.

48. The crystalline solid form of any one of embodiments 1 and 46-47, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 15.12, 15.75, 17.48, 20.05, 21.93, and 26.72, corresponding to d-spacing (angstroms ± 0.2) of 5.86, 5.63, 5.07, 4.43, 4.05, and 3.34, respectively.

49. The crystalline solid form of any one of embodiments 1 and 46-48, wherein Type E of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.59, 15.12, 15.75, 17.48, 20.05, 21.93, 23.18, 23.70, and 26.72.

50. The crystalline solid form of any one of embodiments 1 and 46-49, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.59, 15.12, 15.75, 17.48, 20.05, 21.93, 23.18, 23.70, and 26.72, corresponding to d-spacing (angstroms ± 0.2) of 19.27, 5.86, 5.63, 5.07, 4.43, 4.05, 3.84, 3.75, and 3.34, respectively.

51. The crystalline solid form of any one of embodiments 1 and 46-50, wherein Type E of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.59, 9.76, 12.36, 13.12, 15.12, 15.75, 16.84, 17.48, 18.06, 19.02, 20.05, 21.93, 23.18, 23.70, 26.72, and 27.81.

52. The crystalline solid form of any one of embodiments 1 and 46-51, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.59, 9.76, 12.36, 13.12, 15.12, 15.75, 16.84, 17.48, 18.06, 19.02, 20.05, 21.93, 23.18, 23.70, 26.72, and 27.81, corresponding to d-spacing (angstroms ± 0.2) of 19.27, 9.06, 7.16, 6.75, 5.86, 5.63, 5.27, 5.07, 4.91, 4.67, 4.43, 4.05, 3.84, 3.75, 3.34, and 3.21, respectively.

53. The crystalline solid form of any one of embodiments 1 and 46-52, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.59
8.76
9.76
12.36

13.12
13.83
15.12
15.75
16.84
17.48
18.06
19.02
20.05
21.93
23.18
23.70
24.82
26.72
27.81
29.51
30.76
31.74
33.03
34.52
35.39
36.72
37.77
38.66

54. The crystalline solid form of any one of embodiments 1 and 46-53, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.59	19.27
8.76	10.09
9.76	9.06
12.36	7.16
13.12	6.75
13.83	6.40
15.12	5.86
15.75	5.63
16.84	5.27
17.48	5.07
18.06	4.91

2 theta	d-spacing
19.02	4.67
20.05	4.43
21.93	4.05
23.18	3.84
23.70	3.75
24.82	3.59
26.72	3.34
27.81	3.21
29.51	3.03
30.76	2.91
31.74	2.82
33.03	2.71
34.52	2.60
35.39	2.54
36.72	2.45
37.77	2.38
38.66	2.33

55. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type F of Compound 1.

56. The crystalline solid form of embodiment 1 or 55, wherein Type F of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.45, 14.66, 16.00, 16.79, 20.01, 21.36, and 22.45.

57. The crystalline solid form of any one of embodiments 1 and 55-56, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.45, 14.66, 16.00, 16.79, 20.01, 21.36, and 22.45, corresponding to d-spacing (angstroms ± 0.2) of 16.23, 6.04, 5.54, 5.28, 4.44, 4.16, and 3.96, respectively.

58. The crystalline solid form of any one of embodiments 1 and 55-57, wherein Type F of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.45, 14.66, 16.00, 16.79, 18.99, 20.01, 21.36, 22.45, 23.25, and 25.32.

59. The crystalline solid form of any one of embodiments 1 and 55-58, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.45, 14.66, 16.00, 16.79, 18.99, 20.01, 21.36, 22.45, 23.25, and 25.32, corresponding to d-spacing (angstroms ± 0.2) of 16.23, 6.04, 5.54, 5.28, 4.67, 4.44, 4.16, 3.96, 3.83, and 3.52, respectively.

60. The crystalline solid form of any one of embodiments 1 and 55-59, wherein Type F of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.45, 12.87, 14.66, 16.00, 16.79, 17.36, 18.99, 20.01, 20.57, 21.36, 22.45, 23.25, 25.32, 26.57, 27.25, 27.97, and 30.02.

61. The crystalline solid form of any one of embodiments 1 and 55-60, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.45, 12.87, 14.66, 16.00, 16.79, 17.36, 18.99, 20.01, 20.57, 21.36, 22.45, 23.25, 25.32, 26.57, 27.25, 27.97, and 30.02, corresponding to d-spacing (angstroms ± 0.2) of 16.23, 6.88, 6.04, 5.54, 5.28, 5.11, 4.67, 4.44, 4.32, 4.16, 3.96, 3.83, 3.52, 3.35, 3.27, 3.19, and 2.98, respectively.

62. The crystalline solid form of any one of embodiments 1 and 55-61, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

5.45
10.92
12.87
14.66
16.00
16.79
17.36
18.99
20.01
20.57
21.36
22.45
23.25
25.32
26.57

27.25
27.97
30.02
31.98
32.89
38.29
39.09

63. The crystalline solid form of any one of embodiments 1 and 55-62, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
5.45	16.23
10.92	8.10
12.87	6.88
14.66	6.04
16.00	5.54
16.79	5.28
17.36	5.11
18.99	4.67
20.01	4.44
20.57	4.32
21.36	4.16
22.45	3.96
23.25	3.83
25.32	3.52
26.57	3.35
27.25	3.27
27.97	3.19
30.02	2.98
31.98	2.80
32.89	2.72
38.29	2.35
39.09	2.30

64. The crystalline solid form of any one of embodiments 1 and 55-63, wherein Type F of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 6.2% up to 120 °C.

65. The crystalline solid form of any one of embodiments 1 and 55-64, wherein Type F of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having a peak temperature of about 100.4 °C and an onset temperature of 125.9 °C.
66. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type G of Compound 1.
67. The crystalline solid form of embodiment 1 or 66, wherein Type G of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.36, 14.34, 16.58, and 21.35.
68. The crystalline solid form of any one of embodiments 1 and 66-67, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.36, 14.34, 16.58, and 21.35, corresponding to d-spacing (angstroms ± 0.2) of 16.48, 6.18, 5.35, and 4.16, respectively.
69. The crystalline solid form of any one of embodiments 1 and 66-68, wherein Type G of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.36, 12.83, 14.34, 15.00, 16.58, 19.78, 21.35, 22.35, 25.33, and 26.43.
70. The crystalline solid form of any one of embodiments 1 and 66-69, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.36, 12.83, 14.34, 15.00, 16.58, 19.78, 21.35, 22.35, 25.33, and 26.43, corresponding to d-spacing (angstroms ± 0.2) of 16.48, 6.90, 6.18, 5.91, 5.35, 4.49, 4.16, 3.98, 3.52, and 3.37, respectively.
71. The crystalline solid form of any one of embodiments 1 and 66-70, wherein Type G of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions

at angles ($2\theta \pm 0.2$) of 5.36, 12.83, 14.34, 15.00, 15.79, 16.58, 19.78, 21.35, 22.35, 25.33, 26.43, 27.35, and 30.21.

72. The crystalline solid form of any one of embodiments 1 and 66-71, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.36, 12.83, 14.34, 15.00, 15.79, 16.58, 19.78, 21.35, 22.35, 25.33, 26.43, 27.35, and 30.21, corresponding to d-spacing (angstroms ± 0.2) of 16.48, 6.90, 6.18, 5.91, 5.61, 5.35, 4.49, 4.16, 3.98, 3.52, 3.37, 3.26, and 2.96, respectively.

73. The crystalline solid form of any one of embodiments 1 and 66-72, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

5.36
8.73
12.83
14.34
15.00
15.79
16.58
18.54
19.78
21.35
22.35
23.38
25.33
26.43
27.35
30.21
32.32
38.04

74. The crystalline solid form of any one of embodiments 1 and 66-73, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
5.36	16.48
8.73	10.13

2 theta	d-spacing
12.83	6.90
14.34	6.18
15.00	5.91
15.79	5.61
16.58	5.35
18.54	4.79
19.78	4.49
21.35	4.16
22.35	3.98
23.38	3.80
25.33	3.52
26.43	3.37
27.35	3.26
30.21	2.96
32.32	2.77
38.04	2.37

75. A pharmaceutical composition comprising a therapeutically effective amount of the crystalline solid form of any one of embodiments 1-74, and one or more pharmaceutically acceptable excipients.

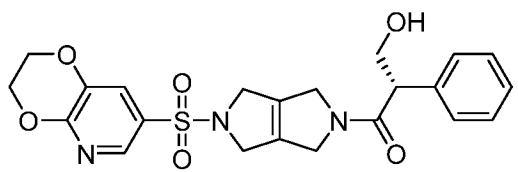
76. The pharmaceutical composition of embodiment 75, wherein the pharmaceutical composition is for oral administration.

77. The pharmaceutical composition of embodiment 75 or 76, wherein the pharmaceutical composition has a water content of about 0.5-5.0 weight%.

78. The pharmaceutical composition of any one of embodiments 75-77, wherein the pharmaceutical composition has a water content of about 1.5-4.0 weight%.

79. The pharmaceutical composition of any one of embodiments 75-78, wherein the pharmaceutical composition has a water content of about 2.5-3.0 weight%.

80. An amorphous solid dispersion comprising Compound 1:



and a polymer.

81. The amorphous solid dispersion of embodiment 80, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof.

82. The amorphous solid dispersion of embodiment 80 or 81, wherein the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

83. The amorphous solid dispersion of any one of embodiments 80-82, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3.

84. The amorphous solid dispersion of any one of embodiments 80-83, wherein the weight ratio of Compound 1 to the polymer is about 1:3.

85. A pharmaceutical composition comprising a therapeutically effective amount of the amorphous solid dispersion of any one of embodiments 80-84, and one or more pharmaceutically acceptable excipients.

86. The pharmaceutical composition of embodiment 85, wherein the pharmaceutical composition is for oral administration.

87. The pharmaceutical composition of embodiment 85 or 86, wherein the pharmaceutical composition is in a tablet dosage form.

88. The pharmaceutical composition of any one of embodiments 85-87, wherein the pharmaceutical composition has a water content of about 0.5-5.0 weight%.
89. The pharmaceutical composition of any one of embodiments 85-88, wherein the pharmaceutical composition has a water content of about 1.5-4.0 weight%.
90. The pharmaceutical composition of any one of embodiments 85-89, wherein the pharmaceutical composition has a water content of about 2.5-3.0 weight%.
91. The pharmaceutical composition of any one of embodiments 85-90, wherein the pharmaceutical composition comprises about 10 mg, about 25 mg, about 50 mg, about 100 mg, about 200 mg, or about 300 mg of Compound 1.
92. The pharmaceutical composition of any one of embodiments 85-91, wherein the pharmaceutical composition comprises about 25 mg of Compound 1.
93. The pharmaceutical composition of any one of embodiments 85-91, wherein the pharmaceutical composition comprises about 100 mg of Compound 1.
94. The pharmaceutical composition of any one of embodiments 85-93, wherein the one or more pharmaceutically acceptable excipients comprise one or more of a filler, a dry binder, a glidant, a lubricant, a disintegrant, and a film coating agent.
95. The pharmaceutical composition of any one of embodiments 85-94, wherein the one or more pharmaceutically acceptable excipients comprise a filler, and the filler comprises microcrystalline cellulose.
96. The pharmaceutical composition of any one of embodiments 85-95, wherein the one or more pharmaceutically acceptable excipients comprise a dry binder, and the dry binder comprises crospovidone.

97. The pharmaceutical composition of any one of embodiments 85-96, wherein the one or more pharmaceutically acceptable excipients comprise a glidant, and the glidant comprises colloidal silicon dioxide.

98. The pharmaceutical composition of any one of embodiments 85-97, wherein the one or more pharmaceutically acceptable excipients comprise a lubricant, and the lubricant comprises magnesium stearate.

99. The pharmaceutical composition of any one of embodiments 85-98, wherein the one or more pharmaceutically acceptable excipients comprise a disintegrant, and the disintegrant comprises croscarmellose sodium.

100. The pharmaceutical composition of any one of embodiments 85-99, wherein the one or more pharmaceutically acceptable excipients comprise a lubricant, and the lubricant comprises magnesium stearate.

101. The pharmaceutical composition of any one of embodiments 85-100, comprising a tablet core, the tablet core comprising:

- an intra granular portion comprising the amorphous solid dispersion; and
- an extra granular portion blended with the intra granular portion.

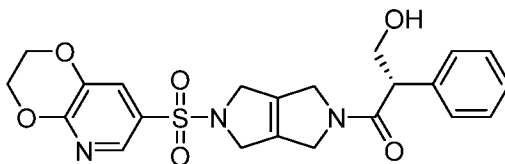
102. The pharmaceutical composition of embodiment 101, further comprising a coating disposed on the tablet core.

103. The pharmaceutical composition of embodiment 101 or 102, wherein the amorphous solid dispersion is about 50 weight% of the tablet core.

104. The pharmaceutical composition of any one of embodiments 101-103, wherein the intra granular portion further comprises one or more of a filler, a dry binder, a glidant, and a lubricant.

105. The pharmaceutical composition of any one of embodiments 101-104, wherein the extra granular portion further comprises one or more of a filler, a disintegrant, and a lubricant.

106. A method for preparing an amorphous solid dispersion comprising Compound 1:



1,

comprising:

mixing Compound 1, a polymer, and a solvent to afford a mixture; and

spray-drying the mixture to afford an amorphous solid dispersion comprising Compound

1.

107. The method of embodiment 106, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof.

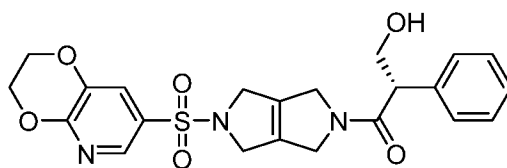
108. The method of embodiment 106 or 107, wherein the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

109. The method of any one of embodiments 106-108, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3.

110. The method of any one of embodiments 106-109, wherein the weight ratio of Compound 1 to the polymer is about 1:3.

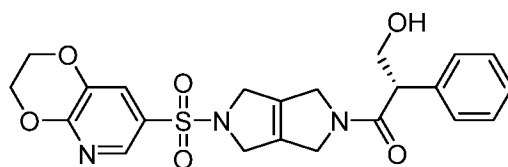
111. The method of any one of embodiments 106-110, wherein the solvent is dichloromethane and methanol.

112. A product prepared by a process comprising:
mixing Compound 1, a polymer, and a solvent to afford a mixture; and
spray-drying the mixture to afford an amorphous solid dispersion comprising Compound 1:



1.

113. The product of embodiment 112, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof.
114. The product of embodiment 112 or 113, wherein the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS).
115. The product of any one of embodiments 112-114, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3.
116. The product of any one of embodiments 112-115, wherein the weight ratio of Compound 1 to the polymer is about 1:3.
117. The product of any one of embodiments 112-116, wherein the solvent is dichloromethane and methanol.
118. A pharmaceutical composition comprising Compound 1:

**1,**

obtained by a process comprising:

mixing Compound 1 in a solid form, a polymer, and a solvent to afford a mixture; and
spray-drying the mixture to afford an amorphous solid dispersion comprising Compound 1.

119. The pharmaceutical composition of embodiment 118, wherein the solid form is Type A of Compound 1.

120. The pharmaceutical composition of embodiment 118, wherein the solid form is Type B of Compound 1.

121. The pharmaceutical composition of embodiment 118, wherein the solid form is Type C of Compound 1.

122. The pharmaceutical composition of embodiment 118, wherein the solid form is Type D of Compound 1.

123. The pharmaceutical composition of embodiment 118, wherein the solid form is Type E of Compound 1.

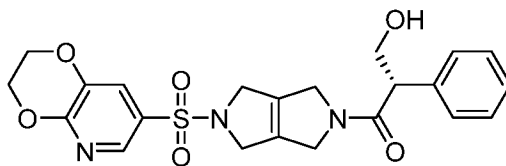
124. The pharmaceutical composition of embodiment 118, wherein the solid form is Type F of Compound 1.

125. The pharmaceutical composition of embodiment 118, wherein the solid form is Type G of Compound 1.

126. The pharmaceutical composition of embodiment 118, wherein the solid form is amorphous form of Compound 1.
127. The pharmaceutical composition of any one of embodiments 118-126, wherein the pharmaceutical composition has a water content of about 0.5-5.0 weight%.
128. The pharmaceutical composition of any one of embodiments 118-127, wherein the pharmaceutical composition has a water content of about 1.5-4.0 weight%.
129. The pharmaceutical composition of any one of embodiments 118-128, wherein the pharmaceutical composition has a water content of about 2.5-3.0 weight%.
130. The pharmaceutical composition of any one of embodiments 118-129, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof.
131. The pharmaceutical composition of any one of embodiments 118-130, wherein the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS).
132. The pharmaceutical composition of any one of embodiments 118-131, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3.
133. The pharmaceutical composition of any one of embodiments 118-132, wherein the weight ratio of Compound 1 to the polymer is about 1:3.
134. The pharmaceutical composition of any one of embodiments 118-133, wherein the solvent is dichloromethane and methanol.

[0219] In some embodiments, the disclosure relates to one or more of the following enumerated embodiments:

1. A crystalline solid form of Compound 1:



2. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type A of (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one ("Compound 1").
3. The crystalline solid form of embodiment 2, wherein Type A of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.7, 23.2, and 24.8.
4. The crystalline solid form of embodiment 2 or 3, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.7, 23.2, and 24.8, corresponding to d-spacing (angstroms ± 0.2) of 19.2, 5.7, 3.8, and 3.6, respectively.
5. The crystalline solid form of any one of embodiments 2-4, wherein Type A of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 21.3, 23.2, and 24.8.
6. The crystalline solid form of any one of embodiments 2-5, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 21.3, 23.2, and 24.8, corresponding to d-spacing (angstroms ± 0.2) of 19.2, 12.3, 5.7, 4.2, 3.8, and 3.6, respectively.

7. The crystalline solid form of any one of embodiment 2-6, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 20.5, 21.3, 21.7, 22.5, 23.2, 24.8, and 26.7.

8. The crystalline solid form of any one of embodiment 2-7, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 20.5, 21.3, 21.7, 22.5, 23.2, 24.8, and 26.7, corresponding to d-spacing (angstroms ± 0.2) of 19.2, 12.2, 5.7, 4.3, 4.2, 4.1, 4.0, 3.8, 3.6, and 3.3, respectively.

9. The crystalline solid form of any one of embodiments 2-8, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.6
5.8
7.2
7.7
11.2
12.3
14.4
15.7
16.9
18.0
19.2
20.5
21.3
21.7
22.5
23.2
24.8
26.7
28.0
28.5
29.4
30.3
32.1
34.1
36.5.

10. The crystalline solid form of any one of embodiments 2-9, wherein Type A of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.6	19.2
5.8	15.2
7.2	12.2
7.7	11.5
11.2	7.9
12.3	7.2
14.4	6.1
15.7	5.7
16.9	5.2
18.0	4.9
19.2	4.6
20.5	4.3
21.3	4.2
21.7	4.1
22.5	4.0
23.2	3.8
24.8	3.6
26.7	3.3
28.0	3.2
28.5	3.1
29.4	3.0
30.3	3.0
32.1	2.8
34.1	2.6
36.5	2.5.

11. The crystalline solid form of any one of embodiments 2-10, wherein Type A of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 1.9% up to 100 °C.

12. The crystalline solid form of any one of embodiments 2-11, wherein Type A of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having a peak temperature of about 85.9 °C and an onset temperature of about 146.0 °C.

13. The crystalline solid form of any one of embodiments 2-12, wherein Type A of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 3.4% water uptake by weight up to 40% relative humidity.
14. The crystalline solid form of any one of embodiments 2-13, wherein Type A of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 1.0% water uptake by weight from 40% to 80% relative humidity.
15. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type B of Compound 1.
16. The crystalline solid form of embodiment 15, wherein Type B of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.9, 23.3, and 25.1.
17. The crystalline solid form of embodiment 15 or 16, wherein Type B of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.9, 23.3, and 25.1, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 5.7, 3.9, 3.8, and 3.5, respectively.
18. The crystalline solid form of any one of embodiments 15-17, wherein Type B of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.2, 22.9, 23.3, and 25.1.
19. The crystalline solid form of any one of embodiments 15-18, wherein Type B of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.2, 22.9, 23.3, and 25.1, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 5.7, 4.0, 3.9, 3.8, and 3.5, respectively.

20. The crystalline solid form of any one of embodiments 15-19, wherein Type B of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 9.9, 15.6, 19.9, 22.2, 22.9, 23.3, 25.1, and 28.3.

21. The crystalline solid form of any one of embodiments 15-20, wherein Type B of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 9.9, 15.6, 19.9, 22.2, 22.9, 23.3, 25.1, and 28.3, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 9.0, 5.7, 4.5, 4.0, 3.9, 3.8, 3.5, and 3.2, respectively.

22. The crystalline solid form of any one of embodiments 15-21, wherein Type B of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.5
9.0
9.9
12.4
13.2
15.6
16.9
18.2
19.1
19.9
20.9
22.2
22.9
23.3
25.1
25.8
26.7
28.3
29.4.

23. The crystalline solid form of any one of embodiments 15-22, wherein Type B of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.5	19.5

2 theta	d-spacing
9.0	9.9
9.9	9.0
12.4	7.2
13.2	6.7
15.6	5.7
16.9	5.3
18.2	4.9
19.1	4.6
19.9	4.5
20.9	4.2
22.2	4.0
22.9	3.9
23.3	3.8
25.1	3.5
25.8	3.5
26.7	3.3
28.3	3.2
29.4	3.0.

24. The crystalline solid form of any one of embodiments 15-23, wherein Type B of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 1.8% up to 100 °C.

25. The crystalline solid form of any one of embodiments 15-24, wherein Type B of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 2.3% up to 120 °C.

26. The crystalline solid form of any one of embodiments 15-25, wherein Type B of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having an onset temperature of about 138.2-139.2 °C.

27. The crystalline solid form of any one of embodiments 15-26, wherein Type B of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 2.9% water uptake by weight up to 60% relative humidity.

28. The crystalline solid form of any one of embodiments 15-27, wherein Type B of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 0.4% water uptake by weight from 60% to 80% relative humidity.
29. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type C of Compound 1.
30. The crystalline solid form of embodiment 29, wherein Type C of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 18.9, 23.0, and 24.7.
31. The crystalline solid form of embodiment 29 or 30, wherein Type C of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 18.9, 23.0, and 24.7, corresponding to d-spacing (angstroms ± 0.2) of 19.4, 4.7, 3.9, and 3.6, respectively.
32. The crystalline solid form of any one of embodiments 29-31, wherein Type C of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 7.3, 11.2, 18.9, 23.0, and 24.7.
33. The crystalline solid form of any one of embodiments 29-32, wherein Type C of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 7.3, 11.2, 18.9, 23.0, and 24.7, corresponding to d-spacing (angstroms ± 0.2) of 19.4, 12.0, 7.9, 4.7, 3.9, and 3.6, respectively.
34. The crystalline solid form of any one of embodiments 29-33, wherein Type C of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 7.3, 9.1, 11.2, 18.3, 18.9, 19.6, 21.7, 23.0, and 24.7.
35. The crystalline solid form of any one of embodiments 9-34, wherein Type C of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of

4.5, 7.3, 9.1, 11.2, 18.3, 18.9, 19.6, 21.7, 23.0, and 24.7, corresponding to d-spacing (angstroms ± 0.2) of 19.4, 12.0, 9.8, 7.9, 4.8, 4.7, 4.5, 4.1, 3.9, and 3.6, respectively.

36. The crystalline solid form of any one of embodiments 29-35, wherein Type C of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.5
7.3
9.1
11.2
12.3
14.5
15.7
18.3
18.9
19.6
20.4
21.7
23.0
24.7
26.4
28.3
30.1
32.3
33.9
37.2.

37. The crystalline solid form of any one of embodiments 29-36, wherein Type C of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.5	19.4
7.3	12.0
9.1	9.8
11.2	7.9
12.3	7.2
14.5	6.1
15.7	5.7
18.3	4.8

2 theta	d-spacing
18.9	4.7
19.6	4.5
20.4	4.4
21.7	4.1
23.0	3.9
24.7	3.6
26.4	3.4
28.3	3.2
30.1	3.0
32.3	2.8
33.9	2.6
37.2	2.4.

38. The crystalline solid form of any one of embodiments 29-37, wherein Type C of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 1.0% up to 100 °C.

39. The crystalline solid form of any one of embodiments 29-38, wherein Type C of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 2.3% up to 130 °C.

40. The crystalline solid form of any one of embodiments 29-39, wherein Type C of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having an onset temperature of about 152.2-154.2 °C.

41. The crystalline solid form of any one of embodiments 29-40, wherein Type C of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 1.8% water uptake by weight up to 60% relative humidity.

42. The crystalline solid form of any one of embodiments 29-41, wherein Type C of Compound 1 is characterized by a dynamic vapor sorption (DVS) of about 0.5% water uptake by weight from 60% to 80% relative humidity.

43. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type D of Compound 1.

44. The crystalline solid form of embodiment 43, wherein Type D of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 9.7, 13.1, 15.7, 21.9, and 23.6.

45. The crystalline solid form of embodiment 43 or 44, wherein Type D of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 9.7, 13.1, 15.7, 21.9, and 23.6, corresponding to d-spacing (angstroms ± 0.2) of 9.1, 6.8, 5.6, 4.1 and 3.8, respectively.

46. The crystalline solid form of any one of embodiments 43-45, wherein Type D of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 6.2, 9.7, 13.1, 15.7, 21.9, and 23.6 and not having a diffraction at an angle ($2\theta \pm 0.2$) of 23.3.

47. The crystalline solid form of any one of embodiments 43-46, wherein Type D of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 6.2, 9.7, 13.1, 15.7, 21.9, and 23.6, corresponding to d-spacing (angstroms ± 0.2) of 14.4, 9.1, 6.8, 5.6, 4.1 and 3.8, respectively, and not having a diffraction at an angle ($2\theta \pm 0.2$) of 23.3.

48. The crystalline solid form of any one of embodiments 43-47, wherein Type D of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.3, 6.2, 8.7, 9.7, 12.3, 13.1, 13.8, 15.7, 18.0, 21.9, 23.6, and 26.7.

49. The crystalline solid form of any one of embodiments 43-48, wherein Type D of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.3, 6.2, 8.7, 9.7, 12.3, 13.1, 13.8, 15.7, 18.0, 21.9, 23.6, and 26.7, corresponding to d-spacing (angstroms ± 0.2) of 20.7, 14.4, 10.2, 9.1, 7.2, 6.8, 6.4, 5.6, 4.9, 4.1, 3.8, and 3.3, respectively.

50. The crystalline solid form of any one of embodiments 43-49, wherein Type D of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.3
6.2
8.7
9.7
12.3
13.1
13.8
15.7
18.0
19.5
21.9
23.6
24.8
26.7
29.5
30.8
31.7
35.4
37.8
38.6.

51. The crystalline solid form of any one of embodiments 43-50, wherein Type D of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.3	20.7
6.2	14.4
8.7	10.2
9.7	9.1
12.3	7.2
13.1	6.8
13.8	6.4
15.7	5.6
18.0	4.9
19.5	4.5
21.9	4.1
23.6	3.8

2 theta	d-spacing
24.8	3.6
26.7	3.3
29.5	3.0
30.8	2.9
31.7	2.8
35.4	2.5
37.8	2.4
38.6	2.3.

52. The crystalline solid form of any one of embodiments 43-51, wherein Type D of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 9.6% up to 130 °C.

53. The crystalline solid form of any one of embodiments 43-52, wherein Type D of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having an onset temperature of about 91.9 °C.

54. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type E of Compound 1.

55. The crystalline solid form of embodiment 54, wherein Type E of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles (2 theta $\pm$ 0.2) of 15.1, 15.8, 17.5, 20.1, 21.9, and 26.7.

56. The crystalline solid form of embodiment 54 or 55, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles (2 theta $\pm$ 0.2) of 15.1, 15.8, 17.5, 20.1, 21.9, and 26.7, corresponding to d-spacing (angstroms $\pm$ 0.2) of 5.9, 5.6, 5.1, 4.4, 4.1, and 3.3, respectively.

57. The crystalline solid form of any one of embodiments 54-56, wherein Type E of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles (2 theta $\pm$ 0.2) of 15.1, 15.8, 17.5, 20.1, 21.9, and 26.7.

58. The crystalline solid form of any one of embodiments 54-57, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 15.1, 15.8, 17.5, 19.0, 20.1, 21.9, and 26.7, corresponding to d-spacing (angstroms ± 0.2) of 5.9, 5.6, 5.1, 4.7, 4.4, 4.1, and 3.3, respectively.

59. The crystalline solid form of any one of embodiments 54-56, wherein Type E of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.1, 15.8, 17.5, 20.1, 21.9, 23.2, 23.7, and 26.7.

60. The crystalline solid form of any one of embodiments 54-56, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.1, 15.8, 17.5, 20.1, 21.9, 23.2, 23.7, and 26.7, corresponding to d-spacing (angstroms ± 0.2) of 19.3, 5.9, 5.6, 5.1, 4.4, 4.1, 3.8, 3.8, and 3.3, respectively.

61. The crystalline solid form of any one of embodiments 54-60, wherein Type E of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 9.8, 12.4, 13.1, 15.1, 15.8, 16.8, 17.5, 18.1, 19.0, 20.1, 21.9, 23.2, 23.7, 26.7, and 27.8.

62. The crystalline solid form of any one of embodiments 54-61, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 9.8, 12.4, 13.1, 15.1, 15.8, 16.8, 17.5, 18.1, 19.0, 20.1, 21.9, 23.2, 23.7, 26.7, and 27.8, corresponding to d-spacing (angstroms ± 0.2) of 19.3, 9.1, 7.2, 6.7, 5.9, 5.6, 5.3, 5.1, 4.9, 4.7, 4.4, 4.1, 3.8, 3.8, 3.3, and 3.2, respectively.

63. The crystalline solid form of any one of embodiments 54-62, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.6

8.8

9.8

12.4

113

13.1
13.8
15.1
15.8
16.8
17.5
18.1
19.0
20.1
21.9
23.2
23.7
24.8
26.7
27.8
29.5
30.8
31.7
33.0
34.5
35.4
36.7
37.8
38.7.

64. The crystalline solid form of any one of embodiments 54-63, wherein Type E of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
4.6	19.3
8.8	10.1
9.8	9.1
12.4	7.2
13.1	6.7
13.8	6.4
15.1	5.9
15.8	5.6
16.8	5.3
17.5	5.1
18.1	4.9

2 theta	d-spacing
19.0	4.7
20.1	4.4
21.9	4.1
23.2	3.8
23.7	3.8
24.8	3.6
26.7	3.3
27.8	3.2
29.5	3.0
30.8	2.9
31.7	2.8
33.0	2.7
34.5	2.6
35.4	2.5
36.7	2.4
37.8	2.4
38.7	2.3.

65. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type F of Compound 1.

66. The crystalline solid form of embodiment 65, wherein Type F of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, and 21.4.

67. The crystalline solid form of embodiment 65 or 66, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, and 21.4, corresponding to d-spacing (angstroms ± 0.2) of 16.2, 6.0, 5.5, 5.3, and 4.2, respectively.

68. The crystalline solid form of any one of embodiments 65-67, wherein Type F of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, 20.0, 21.4, and 22.5.

69. The crystalline solid form of any one of embodiments 65-68, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, 20.0, 21.4, and 22.5, corresponding to d-spacing (angstroms ± 0.2) of 16.2, 6.0, 5.5, 5.3, 4.4, 4.2, and 4.0, respectively.

70. The crystalline solid form of any one of embodiments 65-69, wherein Type F of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, 19.0, 20.0, 21.4, 22.5, 23.2, and 25.3.

71. The crystalline solid form of any one of embodiments 65-70, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.7, 16.0, 16.8, 19.0, 20.0, 21.4, 22.5, 23.2, and 25.3, corresponding to d-spacing (angstroms ± 0.2) of 16.2, 6.0, 5.5, 5.3, 4.7, 4.4, 4.2, 4.0, 3.8, and 3.5, respectively.

72. The crystalline solid form of any one of embodiments 65-71, wherein Type F of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.9, 14.7, 16.0, 16.8, 17.4, 19.0, 20.0, 20.6, 21.4, 22.5, 23.2, 25.3, 26.6, 27.2, 28.0, and 30.0.

73. The crystalline solid form of any one of embodiments 65-72, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.9, 14.7, 16.0, 16.8, 17.4, 19.0, 20.0, 20.6, 21.4, 22.5, 23.2, 25.3, 26.6, 27.2, 28.0, and 30.0, corresponding to d-spacing (angstroms ± 0.2) of 16.2, 6.9, 6.0, 5.5, 5.3, 5.1, 4.7, 4.4, 4.3, 4.2, 4.0, 3.8, 3.5, 3.4, 3.3, 3.2, and 3.0, respectively.

74. The crystalline solid form of any one of embodiments 65-73, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

5.4
10.9
12.9
14.7
16.0

16.8
17.4
19.0
20.0
20.6
21.4
22.5
23.2
25.3
26.6
27.2
28.0
30.0
32.0
32.9
38.3
39.1

75. The crystalline solid form of any one of embodiments 65-74, wherein Type F of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
5.4	16.23
10.9	8.1
12.9	6.9
14.7	6.0
16.0	5.5
16.8	5.3
17.4	5.1
19.0	4.7
20.0	4.4
20.6	4.3
21.4	4.2
22.5	4.0
23.2	3.8
25.3	3.5
26.6	3.4
27.2	3.3
28.0	3.2
30.0	3.0

2 theta	d-spacing
32.0	2.8
32.9	2.7
38.3	2.4
39.1	2.3

76. The crystalline solid form of any one of embodiments 65-75, wherein Type F of Compound 1 is characterized by a thermogravimetric analysis (TGA) thermogram with a weight loss of about 6.2% up to 120 °C.

77. The crystalline solid form of any one of embodiments 65-76, wherein Type F of Compound 1 is characterized by a differential scanning calorimetry (DSC) endotherm having a peak temperature of about 100.4 °C and an onset temperature of 125.9 °C.

78. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type G of Compound 1.

79. The crystalline solid form of embodiment 78, wherein Type G of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles (2 theta $\pm$ 0.2) of 5.4, 14.3, 16.6, and 21.3.

80. The crystalline solid form of embodiment 78 or 79, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles (2 theta $\pm$ 0.2) of 5.4, 14.3, 16.6, and 21.3, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.5, 6.2, 5.3, and 4.2, respectively.

81. The crystalline solid form of any one of embodiments 78-80, wherein Type G of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles (2 theta $\pm$ 0.2) of 5.4, 14.3, 16.6, 21.3, and 22.3.

82. The crystalline solid form of any one of embodiments 78-81, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles (2 theta $\pm$ 0.2) of

5.4, 14.3, 16.6, 21.3, and 22.3, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.5, 6.2, 5.3, 4.2, and 4.0, respectively.

83. The crystalline solid form of any one of embodiments 78-82, wherein Type G of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.8, 14.3, 15.0, 16.6, 19.8, 21.3, 22.3, 25.3, and 26.4.

84. The crystalline solid form of any one of embodiments 78-83, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.8, 14.3, 15.0, 16.6, 19.8, 21.3, 22.3, 25.3, and 26.4, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.5, 6.9, 6.2, 5.9, 5.3, 4.5, 4.2, 4.0, 3.5, and 3.4, respectively.

85. The crystalline solid form of any one of embodiments 78-84, wherein Type G of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.8, 14.3, 15.0, 15.8, 16.6, 19.8, 21.3, 22.3, 25.3, 26.4, 27.4, and 30.2.

86. The crystalline solid form of any one of embodiments 78-85, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 12.8, 14.3, 15.0, 15.8, 16.6, 19.8, 21.3, 22.3, 25.3, 26.4, 27.4, and 30.2, corresponding to d-spacing (angstroms $\pm$ 0.2) of 16.5, 6.9, 6.2, 5.9, 5.6, 5.3, 4.5, 4.2, 4.0, 3.5, 3.4, 3.3, and 3.0, respectively.

87. The crystalline solid form of any one of embodiments 78-86, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

5.4
8.7
12.8
14.3
15.0
15.8
16.6
18.5

19.8
21.3
22.3
23.4
25.3
26.4
27.4
30.2
32.3
38.0

88. The crystalline solid form of any one of embodiments 78-87, wherein Type G of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

2 theta	d-spacing
5.4	16.5
8.7	10.1
12.8	6.9
14.3	6.2
15.0	5.9
15.8	5.6
16.6	5.3
18.5	4.8
19.8	4.5
21.3	4.2
22.3	4.0
23.4	3.8
25.3	3.5
26.4	3.4
27.4	3.3
30.2	3.0
32.3	2.8
38.0	2.4

89. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type H of Compound 1.

90. The crystalline solid form of embodiment 89, wherein Type H of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.8, 14.7, 16.6, 20.0, 21.3, and 25.4.

91. The crystalline solid form of embodiment 89 or 90, wherein Type H of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.8, 14.7, 16.6, 20.0, 21.3, and 25.4, corresponding to d-spacing (angstroms ± 0.2) of 15.3, 6.0, 5.4, 4.4, 4.2, and 3.5, respectively.

92. The crystalline solid form of any one of embodiments 89-91, wherein Type H of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

5.8
8.4
11.5
12.4
13.1
13.7
14.7
14.9
16.0
16.2
16.6
16.9
17.3
17.7
18.3
19.5
20.0
21.3
21.9
23.1
23.6
23.9
24.4
24.9
25.1
25.4
26.2

27.4
28.1
28.4
29.3
29.7
30.4
31.0
32.7
33.4
34.1
34.8
35.5
35.8
36.4
37.1
38.5

93. The crystalline solid form of any one of embodiments 89-92, wherein Type H of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
5.8	15.3
8.4	10.5
11.5	7.7
12.4	7.2
13.1	6.8
13.7	6.5
14.7	6.0
14.9	5.9
16.0	5.6
16.2	5.5
16.6	5.4
16.9	5.3
17.3	5.1
17.7	5.0
18.3	4.8
19.5	4.6
20.0	4.4
21.3	4.2
21.9	4.1
23.1	3.9

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
23.6	3.8
23.9	3.7
24.4	3.7
24.9	3.6
25.1	3.5
25.4	3.5
26.2	3.4
27.4	3.3
28.1	3.2
28.4	3.1
29.3	3.0
29.7	3.0
30.4	2.9
31.0	2.9
32.7	2.7
33.4	2.7
34.1	2.6
34.8	2.6
35.5	2.5
35.8	2.5
36.4	2.5
37.1	2.4
38.5	2.3

94. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type I of Compound 1.

95. The crystalline solid form of embodiment 94, wherein Type I of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.2, 14.6, 15.5, 20.2, and 21.1.

96. The crystalline solid form of embodiment 94 or 95, wherein Type I of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.2, 14.6, 15.5, 20.2, and 21.1, corresponding to d-spacing (angstroms ± 0.2) of 17.1, 6.1, 5.7, 4.4, and 4.2, respectively.

97. The crystalline solid form of any one of embodiments 94-96, wherein Type I of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

5.2
8.8
10.3
12.6
14.6
15.5
16.1
16.3
16.6
17.1
17.6
18.7
18.9
20.2
20.5
20.7
21.1
21.5
22.0
22.3
23.7
24.8
25.2
26.0
26.3
26.5
26.8
27.0
27.5
27.7
28.1
29.6
30.0
30.4
31.3
32.0
32.5
33.2
34.0

34.6
36.9
38.2
38.9
39.5

98. The crystalline solid form of any one of embodiments 94-97, wherein Type I of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
5.2	17.1
8.8	10.1
10.3	8.6
12.6	7.0
14.6	6.1
15.5	5.7
16.1	5.5
16.3	5.4
16.6	5.3
17.1	5.2
17.6	5.0
18.7	4.7
18.9	4.7
20.2	4.4
20.5	4.3
20.7	4.3
21.1	4.2
21.5	4.1
22.0	4.0
22.3	4.0
23.7	3.8
24.8	3.6
25.2	3.5
26.0	3.4
26.3	3.4
26.5	3.4
26.8	3.3
27.0	3.3
27.5	3.2
27.7	3.2
28.1	3.2

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
29.6	3.0
30.0	3.0
30.4	2.9
31.3	2.9
32.0	2.8
32.5	2.8
33.2	2.7
34.0	2.6
34.6	2.6
36.9	2.4
38.2	2.4
38.9	2.3
39.5	2.3

99. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type J of Compound 1.

100. The crystalline solid form of embodiment 99, wherein Type J of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.7, 22.8, 23.1, and 24.5.

101. The crystalline solid form of embodiment 99 or 100, wherein Type J of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.7, 22.8, 23.1, and 24.5, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 15.4, 3.9, 3.8, and 3.6, respectively.

102. The crystalline solid form of any one of embodiments 99-101, wherein Type J of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.5
5.7
7.1
7.7
9.1
10.5
11.2

11.7
12.3
12.9
14.3
14.5
15.4
15.7
16.3
17.3
18.3
18.7
19.3
19.6
20.5
21.2
21.5
22.8
23.1
23.6
24.1
24.5
25.2
25.9
26.4
27.8
29.3
36.2
37.0

103. The crystalline solid form of any one of embodiments 99-102, wherein Type J of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
4.5	19.5
5.7	15.4
7.1	12.7
7.7	11.5
9.1	9.7
10.5	8.4
11.2	7.9
11.7	7.5

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
12.3	7.2
12.9	6.8
14.3	6.2
14.5	6.1
15.4	5.8
15.7	5.7
16.3	5.4
17.3	5.1
18.3	4.9
18.7	4.7
19.3	4.6
19.6	4.5
20.5	4.3
21.2	4.2
21.5	4.1
22.8	3.9
23.1	3.8
23.6	3.8
24.1	3.7
24.5	3.6
25.2	3.5
25.9	3.4
26.4	3.4
27.8	3.2
29.3	3.0
36.2	2.5
37.0	2.4

104. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type K of Compound 1.

105. The crystalline solid form of embodiment 104, wherein Type K of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.4, 15.6, 16.1, 23.2, and 27.4.

106. The crystalline solid form of embodiment 104 or 105, wherein Type K of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.4, 15.6,

16.1, 23.2, and 27.4, corresponding to d-spacing (angstroms $\pm$ 0.2) of 19.2, 5.7, 5.7, 5.5, 3.8, and 3.3, respectively.

107. The crystalline solid form of any one of embodiments 104-106, wherein Type K of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.6
9.3
10.1
12.9
13.9
14.7
15.4
15.6
16.1
17.8
18.3
18.6
19.3
20.0
20.7
21.6
21.9
22.9
23.2
24.4
25.0
25.5
26.0
27.4
28.8
29.2
30.7
31.1
32.7
36.3

108. The crystalline solid form of any one of embodiments 104-107, wherein Type K of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms $\pm$ 0.2) of:

Pos. [°2Th.]	d-spacing [Å]
4.6	19.2
9.3	9.5
10.1	8.7
12.9	6.8
13.9	6.4
14.7	6.0
15.4	5.7
15.6	5.7
16.1	5.5
17.8	5.0
18.3	4.9
18.6	4.8
19.3	4.6
20.0	4.4
20.7	4.3
21.6	4.1
21.9	4.1
22.9	3.9
23.2	3.8
24.4	3.6
25.0	3.6
25.5	3.5
26.0	3.4
27.4	3.3
28.8	3.1
29.2	3.1
30.7	2.9
31.1	2.9
32.7	2.7
36.3	2.5

109. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type L of Compound 1.

110. The crystalline solid form of embodiment 109, wherein Type L of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.9, 11.9, 17.8, 21.6, 23.9, and 36.1.

111. The crystalline solid form of embodiment 109 or 110, wherein Type L of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.9, 11.9, 17.8, 21.6, 23.9, and 36.1, corresponding to d-spacing (angstroms ± 0.2) of 14.9, 7.5, 5.0, 4.1, 3.7, and 2.5, respectively.

112. The crystalline solid form of any one of embodiments 109-111, wherein Type L of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

5.9
8.4
11.9
13.3
14.7
15.0
16.2
16.7
16.9
17.8
18.9
20.4
21.2
21.6
22.2
23.9
24.6
25.5
25.7
26.1
26.8
28.1
28.8
29.9
30.6
31.9
32.4
33.6
34.2
35.6
36.1
38.2

113. The crystalline solid form of any one of embodiments 109-112, wherein Type L of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
5.9	14.9
8.4	10.5
11.9	7.5
13.3	6.6
14.7	6.0
15.0	5.9
16.2	5.5
16.7	5.3
16.9	5.2
17.8	5.0
18.9	4.7
20.4	4.4
21.2	4.2
21.6	4.1
22.2	4.0
23.9	3.7
24.6	3.6
25.5	3.5
25.7	3.5
26.1	3.4
26.8	3.3
28.1	3.2
28.8	3.1
29.9	3.0
30.6	2.9
31.9	2.8
32.4	2.8
33.6	2.7
34.2	2.6
35.6	2.5
36.1	2.5
38.2	2.4

114. The crystalline solid form of embodiment 1, wherein the crystalline solid form is Type M of Compound 1.

115. The crystalline solid form of embodiment 114, wherein Type M of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.8, 9.7, 15.6, 21.9, and 26.7.

116. The crystalline solid form of embodiment 114 or 115, wherein Type M of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.8, 9.7, 15.6, 21.9, and 26.7, corresponding to d-spacing (angstroms ± 0.2) of 19.5, 15.3, 9.1, 5.7, 4.1, and 3.3, respectively.

117. The crystalline solid form of any one of embodiments 114-116, wherein Type M of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) of:

4.5
5.8
6.1
8.7
9.0
9.7
12.3
13.1
13.7
14.5
15.1
15.6
16.8
17.4
18.0
18.5
19.5
20.0
21.4
21.9
22.3
22.9
23.3
23.5
24.1

25.0
25.8
26.3
26.7
27.8
28.1
29.4
30.8
31.7
33.0
35.3
37.8
38.6

118. The crystalline solid form of any one of embodiments 114-117, wherein Type M of Compound 1 is characterized by an XRPD pattern having diffractions at angles ($2\theta \pm 0.2$) corresponding to d-spacing (angstroms ± 0.2) of:

Pos. [2θ .]	d-spacing [$\text{\AA}$]
4.5	19.5
5.8	15.3
6.1	14.4
8.7	10.2
9.0	9.9
9.7	9.1
12.3	7.2
13.1	6.8
13.7	6.4
14.5	6.1
15.1	5.9
15.6	5.7
16.8	5.3
17.4	5.1
18.0	4.9
18.5	4.8
19.5	4.5
20.0	4.4
21.4	4.1
21.9	4.1
22.3	4.0
22.9	3.9
23.3	3.8

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
23.5	3.8
24.1	3.7
25.0	3.6
25.8	3.5
26.3	3.4
26.7	3.3
27.8	3.2
28.1	3.2
29.4	3.0
30.8	2.9
31.7	2.8
33.0	2.7
35.3	2.5
37.8	2.4
38.6	2.3

119. The crystalline solid form of embodiment 1, wherein the crystalline solid form is selected from the group consisting of:

- 1) Type A of Compound 1, wherein Type A of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 7.2, 15.7, 21.4, 23.2, and 24.8;
- 2) Type B of Compound 1, wherein Type B of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 15.6, 22.2, 22.9, 23.3, and 25.1;
- 3) Type C of Compound 1, wherein Type C of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 7.3, 11.2, 18.9, 23.0, and 24.7;
- 4) Type D of Compound 1, wherein Type D of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 6.2, 9.7, 13.1, 15.7, 21.9, and 23.6 and not having a diffraction at an angle ($2\theta \pm 0.2$) of 23.3;
- 5) Type E of Compound 1, wherein Type E of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 15.1, 15.8, 17.5, 20.1, 21.9, and 26.7;

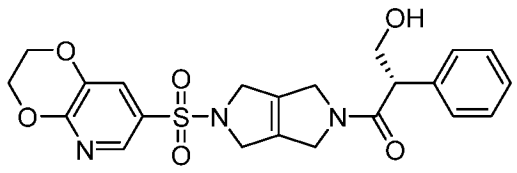
- 6) Type F of Compound 1, wherein Type F of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.5, 14.7, 16.0, 16.8, and 21.4;
 - 7) Type G of Compound 1, wherein Type G of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.4, 14.3, 16.6, 21.3, and 22.3;
 - 8) Type H of Compound 1, wherein Type H of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.8, 14.7, 16.6, 20.0, 21.3, and 25.4;
 - 9) Type I of Compound 1, wherein Type I of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.2, 14.6, 15.5, 20.2, and 21.1;
 - 10) Type J of Compound 1, wherein Type J of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.7, 22.8, 23.1, and 24.5;
 - 11) Type K of Compound 1, wherein Type K of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.6, 15.4, 15.6, 16.1, 23.2, and 27.4;
 - 12) Type L of Compound 1, wherein Type L of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 5.9, 11.9, 17.8, 21.6, 23.9, and 36.1; and
 - 13) Type M of Compound 1, wherein Type M of Compound 1 is characterized by an X-ray powder diffraction (XRPD) pattern having diffractions at angles ($2\theta \pm 0.2$) of 4.5, 5.8, 9.7, 15.6, 21.9, and 26.7.
120. A pharmaceutical composition comprising a therapeutically effective amount of the crystalline solid form of any one of embodiments 1-119, and one or more pharmaceutically acceptable excipients.
121. The pharmaceutical composition of embodiment 120, wherein the pharmaceutical composition is for oral administration.

122. The pharmaceutical composition of embodiment 120 or 121, wherein the pharmaceutical composition has a water content of about 0.5-5.0 weight%.

123. The pharmaceutical composition of any one of embodiments 120-122, wherein the pharmaceutical composition has a water content of about 1.5-4.0 weight%.

124. The pharmaceutical composition of any one of embodiments 120-123, wherein the pharmaceutical composition has a water content of about 2.5-3.0 weight%.

125. An amorphous solid dispersion comprising Compound 1:



and a polymer.

126. The amorphous solid dispersion of embodiment 125, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof.

127. The amorphous solid dispersion of embodiment 125 or 126, wherein the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

128. The amorphous solid dispersion of any one of embodiments 125-127, wherein the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

129. The amorphous solid dispersion of any one of embodiments 125-128, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3 or about 2:1 to about 1:3.

130. The amorphous solid dispersion of any one of embodiments 125-129, wherein the weight ratio of Compound 1 to the polymer is about 1:3.

131. The amorphous solid dispersion of any one of embodiments 125-129, wherein the weight ratio of Compound 1 to the polymer is about 1:1.

132. The amorphous solid dispersion of any one of embodiments 125-129, wherein the weight ratio of Compound 1 to the polymer is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1.

133. The amorphous solid dispersion of any one of embodiments 125-132, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion.

134. The amorphous solid dispersion of any one of embodiments 125-133, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in a container as described in Example 20 for 5 months at 2-8 °C and ambient relative humidity.

135. The amorphous solid dispersion of any one of embodiments 125-134, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in a container as described in Example 20 for 5 months at 25 °C and 60 % relative humidity.

136. The amorphous solid dispersion of any one of embodiments 125-135, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in a container as described in Example 20 for 1 month at 2-8 °C and ambient relative humidity.

137. The amorphous solid dispersion of any one of embodiments 125-136, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in a container as described in Example 20 for 1 month at 25 °C and 60 % relative humidity.

138. The amorphous solid dispersion of any one of embodiments 125-137, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in a container as described in Example 20 for 1 month at 40 °C and 75 % relative humidity.

139. The amorphous solid dispersion of any one of embodiments 125-138, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion.

140. The amorphous solid dispersion of any one of embodiments 125-139, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in a container as described in Example 20 for 5 months at 2-8 °C and ambient relative humidity.

141. The amorphous solid dispersion of any one of embodiments 125-140, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in a container as described in Example 20 for 5 months at 25 °C and 60 % relative humidity.

142. The amorphous solid dispersion of any one of embodiments 125-141, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in a container as described in Example 20 for 1 month at 2-8 °C and ambient relative humidity.

143. The amorphous solid dispersion of any one of embodiments 125-142, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in a container as described in Example 20 for 1 month at 25 °C and 60 % relative humidity.

144. The amorphous solid dispersion of any one of embodiments 125-143, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in a container as described in Example 20 for 1 month at 40 °C and 75 % relative humidity.

145. The amorphous solid dispersion of any one of embodiments 125-144, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion.

146. The amorphous solid dispersion of any one of embodiments 125-145, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in a sealed vial for 1 week at 60 °C.

147. The amorphous solid dispersion of any one of embodiments 125-146, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in a sealed vial for 2 weeks at 60 °C.

148. The amorphous solid dispersion of any one of embodiments 125-147, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in an unsealed vial for 1 week at 25 °C and 60% relative humidity.

149. The amorphous solid dispersion of any one of embodiments 125-148, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in an unsealed vial for 2 weeks at 25 °C and 60% relative humidity.

150. The amorphous solid dispersion of any one of embodiments 125-149, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in an unsealed vial for 1 week at 40 °C and 75% relative humidity.

151. The amorphous solid dispersion of any one of embodiments 125-150, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in an unsealed vial for 2 weeks at 40 °C and 75% relative humidity.

152. The amorphous solid dispersion of any one of embodiments 125-151, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in an unsealed vial for 1 week at 60 °C and 75% relative humidity.

153. The amorphous solid dispersion of any one of embodiments 125-152, wherein crystalline diffraction peaks are not observable by XRPD analysis (Method D) of the amorphous solid dispersion after storage in an unsealed vial for 2 weeks at 60 °C and 75% relative humidity.

154. The amorphous solid dispersion of any one of embodiments 125-136, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion.

155. The amorphous solid dispersion of any one of embodiments 125-154, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in a sealed vial for 1 week or 2 weeks at 60 °C.

156. The amorphous solid dispersion of any one of embodiments 125-155, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method

B) of the amorphous solid dispersion after storage in an unsealed vial for 1 week or 2 weeks at 25 °C and 60% relative humidity.

157. The amorphous solid dispersion of any one of embodiments 125-156, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in an unsealed vial for 1 week or 2 weeks at 40 °C and 75% relative humidity.

158. The amorphous solid dispersion of any one of embodiments 125-157, wherein a single glass transition temperature (T_g) and no melt endotherm is observable by DSC analysis (Method B) of the amorphous solid dispersion after storage in an unsealed vial for 1 week or 2 weeks at 60 °C and 75% relative humidity.

159. The amorphous solid dispersion of any one of embodiments 125-158, wherein Compound 1 has a concentration of at least 300 µg/mL after 30 minutes in the kinetic solubility experiment described in Example 23.

160. The amorphous solid dispersion of any one of embodiments 125-159, wherein Compound 1 has a C_{max} of at least 600 µg/mL in the kinetic solubility experiment described in Example 23.

161. The amorphous solid dispersion of any one of embodiments 125-160, wherein Compound 1 has a concentration of at least 450 µg/mL after 4 hours in the kinetic solubility experiment described in Example 23.

162. The amorphous solid dispersion of any one of embodiments 125-158, wherein Compound 1 has a concentration of at least 200 µg/mL after 16 hours in the kinetic solubility experiment described in Example 23.

163. A pharmaceutical composition comprising a therapeutically effective amount of the amorphous solid dispersion of any one of embodiments 125-162, and one or more pharmaceutically acceptable excipients.

164. The pharmaceutical composition of embodiment 163, wherein the pharmaceutical composition is for oral administration.

165. The pharmaceutical composition of embodiment 163 or 164, wherein the pharmaceutical composition is in a tablet dosage form.

166. The pharmaceutical composition of any one of embodiments 163-165, wherein the pharmaceutical composition has a water content of about 0.5-5.0 weight%.

167. The pharmaceutical composition of any one of embodiments 163-166, wherein the pharmaceutical composition has a water content of about 1.5-4.0 weight%.

168. The pharmaceutical composition of any one of embodiments 163-167, wherein the pharmaceutical composition has a water content of about 2.5-3.0 weight%.

169. The pharmaceutical composition of any one of embodiments 163-168, wherein the pharmaceutical composition comprises about 10 mg, about 25 mg, about 50 mg, about 100 mg, about 200 mg, or about 300 mg of Compound 1.

170. The pharmaceutical composition of any one of embodiments 163-169, wherein the pharmaceutical composition comprises about 25 mg of Compound 1.

171. The pharmaceutical composition of any one of embodiments 163-169, wherein the pharmaceutical composition comprises about 100 mg of Compound 1.

172. The pharmaceutical composition of any one of embodiments 163-169, wherein the pharmaceutical composition comprises about 200 mg of Compound 1.

173. The pharmaceutical composition of any one of embodiments 163-172, wherein the one or more pharmaceutically acceptable excipients comprise one or more of a filler, a dry binder, a glidant, a lubricant, a disintegrant, and a film coating agent.

174. The pharmaceutical composition of any one of embodiments 163-173, wherein the one or more pharmaceutically acceptable excipients comprise a filler, and the filler comprises microcrystalline cellulose.

175. The pharmaceutical composition of any one of embodiments 163-174, wherein the one or more pharmaceutically acceptable excipients comprise a filler, and the filler comprises lactose monohydrate.

176. The pharmaceutical composition of any one of embodiments 163-175, wherein the one or more pharmaceutically acceptable excipients comprise a dry binder, and the dry binder comprises crospovidone.

177. The pharmaceutical composition of any one of embodiments 163-176, wherein the one or more pharmaceutically acceptable excipients comprise a glidant, and the glidant comprises colloidal silicon dioxide.

178. The pharmaceutical composition of any one of embodiments 163-177, wherein the one or more pharmaceutically acceptable excipients comprise a lubricant, and the lubricant comprises magnesium stearate.

179. The pharmaceutical composition of any one of embodiments 163-178, wherein the one or more pharmaceutically acceptable excipients comprise a disintegrant, and the disintegrant comprises croscarmellose sodium.

180. The pharmaceutical composition of any one of embodiments 163-179, comprising a tablet core, the tablet core comprising:

an intra granular portion comprising the amorphous solid dispersion; and

an extra granular portion blended with the intra granular portion.

181. The pharmaceutical composition of embodiment 180, further comprising a coating disposed on the tablet core.

182. The pharmaceutical composition of embodiment 180 or 181, wherein the amorphous solid dispersion is at least about 30 weight % of the tablet core.

183. The pharmaceutical composition of any one of embodiments 180-182, wherein the amorphous solid dispersion is at least about 50 weight % of the tablet core.

184. The pharmaceutical composition of any one of embodiments 180-183, wherein the amorphous solid dispersion is at least about 60 weight % of the tablet core.

185. The pharmaceutical composition of any one of embodiments 180-184, wherein the amorphous solid dispersion is about 50 weight % of the tablet core.

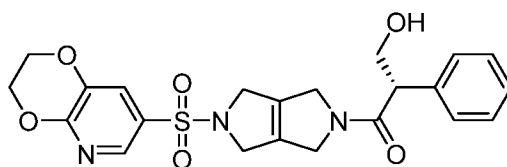
186. The pharmaceutical composition of any one of embodiments 180-185, wherein the amorphous solid dispersion is about 50 to about 70 weight % of the tablet core.

187. The pharmaceutical composition of any one of embodiments 180-186, wherein the amorphous solid dispersion is about 60 to about 65 weight % of the tablet core.

188. The pharmaceutical composition of any one of embodiments 180-187, wherein the intra granular portion further comprises one or more of a filler, a dry binder, a glidant, and a lubricant.

189. The pharmaceutical composition of any one of embodiments 180-188, wherein the extra granular portion further comprises one or more of a filler, a disintegrant, and a lubricant.

190. A method for preparing an amorphous solid dispersion comprising Compound 1:



1,

comprising:

mixing Compound 1, a polymer, and a solvent to afford a mixture; and
 spray-drying the mixture to afford an amorphous solid dispersion comprising Compound 1.

191. The method of embodiment 190, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof.

192. The method of embodiment 190 or 191, wherein the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

193. The method of any one of embodiments 190-192, wherein the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

194. The method of any one of embodiments 190-193, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3 or about 2:1 to about 1:3.

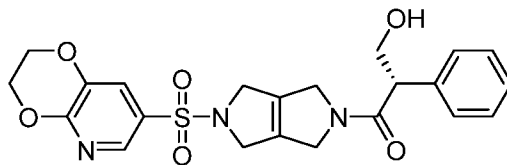
195. The method of any one of embodiments 190-194, wherein the weight ratio of Compound 1 to the polymer is about 1:3.

196. The method of any one of embodiments 190-194, wherein the weight ratio of Compound 1 to the polymer is about 1:1.

197. The method of any one of embodiments 190-194, wherein the weight ratio of Compound 1 to the polymer is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1.

198. The method of any one of embodiments 190-197, wherein the solvent is dichloromethane and methanol.

199. A product prepared by a process comprising:
mixing Compound 1, a polymer, and a solvent to afford a mixture; and
spray-drying the mixture to afford an amorphous solid dispersion comprising Compound 1:



1.

200. The product of embodiment 199, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol®

HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof.

201. The product of embodiment 199 or 200, wherein the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

202. The product of any one of embodiments 199-201, wherein the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

203. The product of any one of embodiments 199-202, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3 or about 2:1 to about 1:3.

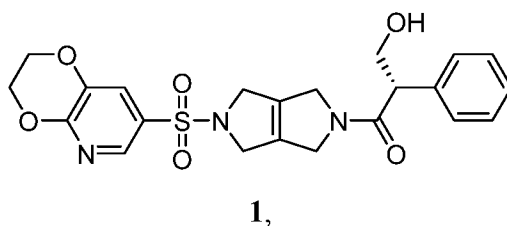
204. The product of any one of embodiments 199-203, wherein the weight ratio of Compound 1 to the polymer is about 1:3.

205. The product of any one of embodiments 199-203, wherein the weight ratio of Compound 1 to the polymer is about 1:1.

206. The product of any one of embodiments 199-203, wherein the weight ratio of Compound 1 to the polymer is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1.

207. The product of any one of embodiments 199-206, wherein the solvent is dichloromethane and methanol.

208. A pharmaceutical composition comprising Compound 1:



obtained by a process comprising:

- mixing Compound 1 in a solid form, a polymer, and a solvent to afford a mixture; and spray-drying the mixture to afford an amorphous solid dispersion comprising Compound 1.
209. The pharmaceutical composition of embodiment 208, wherein the solid form is Type A of Compound 1.
210. The pharmaceutical composition of embodiment 208, wherein the solid form is Type B of Compound 1.
211. The pharmaceutical composition of embodiment 208, wherein the solid form is Type C of Compound 1.
212. The pharmaceutical composition of embodiment 208, wherein the solid form is Type D of Compound 1.
213. The pharmaceutical composition of embodiment 208, wherein the solid form is Type E of Compound 1.
214. The pharmaceutical composition of embodiment 208, wherein the solid form is Type F of Compound 1.
215. The pharmaceutical composition of embodiment 208, wherein the solid form is Type G of Compound 1.
216. The pharmaceutical composition of embodiment 208, wherein the solid form is Type H of Compound 1.
217. The pharmaceutical composition of embodiment 208, wherein the solid form is Type I of Compound 1.

218. The pharmaceutical composition of embodiment 208, wherein the solid form is Type J of Compound 1.

219. The pharmaceutical composition of embodiment 208, wherein the solid form is Type K of Compound 1.

220. The pharmaceutical composition of embodiment 208, wherein the solid form is Type L of Compound 1.

221. The pharmaceutical composition of embodiment 208, wherein the solid form is Type M of Compound 1.

222. The pharmaceutical composition of embodiment 208, wherein the solid form is selected from the group consisting of Type A, Type B, Type C, Type D, Type E, Type F, Type G, Type H, Type I, Type J, Type K, Type L, and Type M of Compound 1.

223. The pharmaceutical composition of embodiment 208, wherein the solid form is amorphous form of Compound 1.

224. The pharmaceutical composition of any one of embodiments 208-223, wherein the pharmaceutical composition has a water content of about 0.5-5.0 weight%.

225. The pharmaceutical composition of any one of embodiments 208-224, wherein the pharmaceutical composition has a water content of about 1.5-4.0 weight%.

226. The pharmaceutical composition of any one of embodiments 208-225, wherein the pharmaceutical composition has a water content of about 2.5-3.0 weight%.

227. The pharmaceutical composition of any one of embodiments 208-226, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose

phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof.

228. The pharmaceutical composition of any one of embodiments 208-227, wherein the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

229. The pharmaceutical composition of any one of embodiments 208-228, wherein the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

230. The pharmaceutical composition of any one of embodiments 208-229, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3 or about 2:1 to about 1:3.

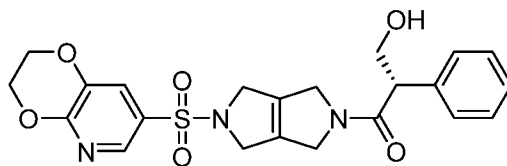
231. The pharmaceutical composition of any one of embodiments 208-230, wherein the weight ratio of Compound 1 to the polymer is about 1:3.

232. The pharmaceutical composition of any one of embodiments 208-230, wherein the weight ratio of Compound 1 to the polymer is about 1:1.

233. The pharmaceutical composition of any one of embodiments 208-230, wherein the weight ratio of Compound 1 to the polymer is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1.

234. The pharmaceutical composition of any one of embodiments 208-233, wherein the solvent is dichloromethane and methanol.

235. A tablet dosage form comprising a tablet core, the tablet core comprising at least 10 weight % of Compound 1 in amorphous form:



1,

wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core.

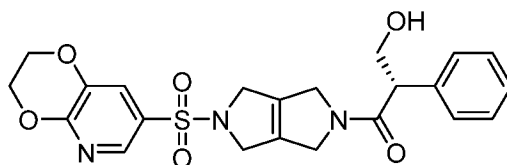
236. The tablet dosage form of embodiment 235, wherein the tablet core comprises at least 15 weight % of Compound 1 in amorphous form.

237. The tablet dosage form of embodiment 235 or 236, wherein the tablet core comprises at least 30 weight % of Compound 1 in amorphous form.

238. The tablet dosage form of any one of embodiments 235-237, wherein the tablet core comprises about 200 mg of Compound 1 per tablet and has a total weight of no more than about 1200 mg per tablet.

239. The tablet dosage form of embodiment 238, wherein the tablet core has a total weight of no more than about 1100 mg, about 1000 mg, about 900 mg, about 800 mg, or about 700 mg per tablet.

240. A tablet dosage form comprising a tablet core, the tablet core having a total weight of no more than about 1000 mg and comprising about 200 mg of Compound 1 in amorphous form per tablet:

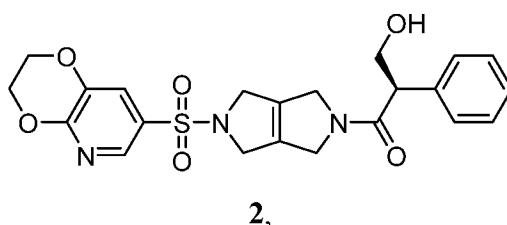


1,

wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core.

241. The tablet dosage form of embodiment 240, wherein the tablet core has a total weight of no more than about 800 mg per tablet.

242. The tablet dosage form of any one of embodiments 235-241, wherein the tablet core comprises 0.05-5.0 % of Compound 2:



based on the total amount of Compound 1 and Compound 2.

243. The tablet dosage form of embodiment 242, wherein the tablet core comprises 0.05-3.0 % of Compound 2, based on the total amount of Compound 1 and Compound 2.

244. The tablet dosage form of embodiment 242 or 243, wherein the tablet core comprises 0.05-2.0 % of Compound 2, based on the total amount of Compound 1 and Compound 2.

245. The tablet dosage form of any one of embodiments 242-244, wherein the tablet core comprises 0.05-1.0 % of Compound 2, based on the total amount of Compound 1 and Compound 2.

246. The tablet dosage form of any one of embodiments 235-245, wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core after storage in a sealed container as described in Example 29 for 1 month at 25 °C and 60 % relative humidity.

247. The tablet dosage form of any one of embodiments 235-246, wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core after storage in a sealed container as described in Example 29 for 2 months at 25 °C and 60 % relative humidity.

248. The tablet dosage form of any one of embodiments 235-247, wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core after storage in a sealed container as described in Example 29 for 3 months at 25 °C and 60 % relative humidity.

249. The tablet dosage form of any one of embodiments 235-248, wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core after storage in a sealed container as described in Example 29 for 1 month at 40 °C and 75 % relative humidity.

250. The tablet dosage form of any one of embodiments 235-249, wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core after storage in a sealed container as described in Example 29 for 2 months at 40 °C and 75 % relative humidity.

251. The tablet dosage form of any one of embodiments 235-250, wherein crystalline Compound 1 (Type A) is not observable by XRPD analysis (Method D) of the tablet core after storage in a sealed container as described in Example 29 for 3 months at 40 °C and 75 % relative humidity.

252. The tablet dosage form of any one of embodiments 235-251, wherein Compound 1 is present in an amorphous solid dispersion comprising Compound 1 and a polymer.

253. The tablet dosage form of embodiment 252, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl

cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof.

254. The tablet dosage form of embodiment 252 or 253, wherein the polymer is hydroxypropylmethyl cellulose (HPMC) or hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

255. The tablet dosage form of any one of embodiments 252-254, wherein the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

256. The tablet dosage form of any one of embodiments 252-255, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3 or about 2:1 to about 1:3.

257. The tablet dosage form of any one of embodiments 252-256, wherein the weight ratio of Compound 1 to the polymer is about 1:3.

258. The tablet dosage form of any one of embodiments 252-256, wherein the weight ratio of Compound 1 to the polymer is about 1:1.

259. The tablet dosage form of any one of embodiments 252-256, wherein the weight ratio of Compound 1 to the polymer is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1.

260. The tablet dosage form of any one of embodiments 235-259, further comprising one or more pharmaceutically acceptable excipients.

261. The tablet dosage form of embodiment 260, wherein the one or more pharmaceutically acceptable excipients comprise one or more of a filler, a dry binder, a glidant, a lubricant, a disintegrant, and a film coating agent.

262. The tablet dosage form of any one of embodiments 235-261, wherein the tablet core comprises:

- an intra granular portion comprising Compound 1; and
- an extra granular portion blended with the intra granular portion.

263. The tablet dosage form of embodiment 262, wherein the intragranular portion comprises an amorphous solid dispersion comprising Compound 1 and a polymer and one or more of a filler, a dry binder, a glidant, and a lubricant, and the extragranular portion comprises one or more of a filler, a disintegrant, and a lubricant.

264. The tablet dosage form of any one of embodiments 235-263, wherein the intragranular portion comprises:

- an amorphous solid dispersion of Compound 1 in an amount of 30-70 weight % of the tablet core;

- one or more fillers in an amount of 15-50 weight % of the tablet core;

- one or more dry binders in an amount of 2.50-10 weight % of the tablet core;

- one or more glidants in an amount of 0.50-1.50 weight % of the tablet core; and

- one or more lubricants in an amount of 0.25-1 weight % of the tablet core; and

the extragranular portion comprises:

- one or more fillers in an amount of 5-15 weight % of the tablet core;

- one or more disintegrants in an amount of 1.25-5 weight % of the tablet core; and

- one or more lubricants in an amount of 0.25-1 weight % of the tablet core; or

wherein the tablet dosage form comprises:

- an amorphous solid dispersion of Compound 1 in an amount of 50-75 weight % of the tablet core;

- one or more fillers in an amount of 15-50 weight % of the tablet core;

- one or more dry binders in an amount of 2-10 weight % of the tablet core;

one or more glidants in an amount of <2 weight % of the tablet core;
one or more disintegrants in an amount of 2-10 weight % of the tablet core; and
one or more lubricants in an amount of <2 weight % of the tablet core.

265. The tablet dosage form of embodiment 264, wherein the amorphous solid dispersion comprises Compound 1 and a polymer.

266. The tablet dosage form of embodiment 265, wherein the polymer is selected from a group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof.

267. The tablet dosage form of embodiment 265 or 266, wherein the polymer is hydroxypropylmethyl cellulose acetate succinate (HPMC AS).

268. The tablet dosage form of any one of embodiments 265-267, wherein the weight ratio of Compound 1 to the polymer is in a range of about 3:1 to about 1:3 or about 2:1 to about 1:3.

269. The tablet dosage form of any one of embodiments 265-268, wherein the weight ratio of Compound 1 to the polymer is about 1:3.

270. The tablet dosage form of any one of embodiments 265-269, wherein the weight ratio of Compound 1 to the polymer is about 1:1.

271. The tablet dosage form of any one of embodiments 265-270, wherein the weight ratio of Compound 1 to the polymer is about 1:3, about 2:3, about 1:1, about 1.5:1, about 2:1, or about 3:1.

272. The tablet dosage form of any one of embodiments 264-271, wherein the one or more fillers comprise microcrystalline cellulose or lactose monohydrate.

273. The tablet dosage form of any one of embodiments 264-272, wherein the one or more dry binders comprise crospovidone or crosslinked polyvinylpyrrolidone.

274. The tablet dosage form of any one of embodiments 264-273, wherein the one or more glidants comprise colloidal silicon dioxide or fumed silica.

275. The tablet dosage form of any one of embodiments 264-274, wherein the one or more lubricants comprise magnesium stearate.

276. The tablet dosage form of any one of embodiments 264-275, wherein the one or more disintegrants comprise crocarmellose sodium.

277. A solid oral dosage form comprising a stabilized amorphous compound (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one, wherein the stabilized amorphous compound does not show crystallinity by PXRD (Method D) after 2 weeks of storage at 60 °C/75% RH (exposed).

278. The solid oral dosage form of embodiment 277, wherein the stabilized amorphous compound shows a single glass transition temperature (T_g) and no melt endotherm by DSC (Method B) after 2 weeks of storage at 60 °C/75% RH (exposed).

279. The solid oral dosage form of embodiment 277 or 278, wherein the solid oral dosage form contains a total of 200 mg of (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one.

280. The solid oral dosage form of any one of embodiments 277-279, wherein the solid oral dosage form has a total weight of not more than 800 mg.

281. The solid oral dosage form of any one of embodiments 277-280, wherein the solid oral dosage form is a tablet or capsule.

282. The solid oral dosage form of any one of embodiments 277-281, wherein the stabilized amorphous compound is in a spray dried dispersion with a polymer.

283. The solid oral dosage form of embodiment 282, wherein the polymer is selected from the group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof, or is selected from a group consisting of polyvinylpyrrolidone (PVP), hydroxypropylmethyl cellulose (HPMC), hydroxypropylcellulose (HPC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxyethylcellulose (HEC), poly(methacrylic acid-co-methyl methacrylates) (e.g., Eudragit® L100-55), macrogol 15 hydroxystearate (e.g., Solutol® HS15), polyvinyl caprolactam-polyvinyl acetate-polyethylene glycol graft copolymer (e.g., Soluplus®), polyethylene glycol (PEG), and a combination thereof.

284. The solid oral dosage form of embodiment 283, wherein the polymer is HPMC AS.

285. The solid oral dosage form of embodiment 284, wherein the (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one is spray dried with HPMC AS in a weight ratio of 1:3 to 2:1.

286. The solid oral dosage form of embodiment 284, wherein the (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one is spray dried with HPMC AS in a weight ratio of 1:1.

287. A (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one active pharmaceutical ingredient (API) composition comprising 0.05-5.0% by HPLC of (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one.

288. A tablet comprising 200 mg of stabilized amorphous compound (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one as the active pharmaceutical ingredient (API), wherein the stabilized amorphous compound does not show crystallinity by PXRD (Method D) after 2 weeks of storage of the tablet at 60 °C/75% RH (exposed).

289. The tablet of embodiment 288, wherein the API comprises less than 5.0% by HPLC of (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one.

290. The tablet of embodiment 288 or 289, wherein the API comprises less than 0.05% by HPLC of (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one.

291. The tablet of any one of embodiments 288-290, having a total weight of less than 800 mg.

EXAMPLES

[0220] The present teachings include descriptions provided in the Examples that are not intended to limit the scope of any claim. The following non-limiting examples are provided to further illustrate the present teachings. Those of skill in the art, in light of the present application, will appreciate that many changes can be made in the specific embodiments that are provided herein and still obtain a like or similar result without departing from the spirit and scope of the present teachings.

Abbreviations

ACN	Acetonitrile	MTBE	Methyl tert-butyl ether
API	Active Pharmaceutical Ingredient	n-Bu	n-butyl
AUC _{last}	Area under the curve from zero to the last measurable point	ND	Not determined
DCM	Dichloromethane	NMP	N-methyl pyrrolidone
DIEA	Diisopropylethylamine	NMR	Nuclear magnetic resonance
DMAc	Dimethylacetamide	PTFE	Polytetrafluoroethylene
DMF	Dimethylformamide	RH	Relative humidity
DMSO	Dimethyl sulfoxide	RRT	Relative retention time
DSC	Differential scanning calorimetry	RT	Room Temperature
DVS	Dynamic vapor sorption	Rt	Retention time
EtOAc	Ethyl acetate	scfh	Standard cubic feet per hour
EtOH	Ethanol	SDD	Spray-dried dispersion
FaSSIF	Fasted state simulated intestinal fluid	SEM	Scanning electron microscopy
FeSSIF	Fed state simulated intestinal fluid	SGF	Simulated gastric fluid
h	Hour	SIF	Simulated intestinal fluid
HATU	1-[bis(dimethylamino)methylene]-1H-1,2,3-triazolo[4,5-b]pyridinium 3-oxide hexafluoro-phosphate	TEA	Triethylamine
HPLC	High-performance liquid chromatography	TFA	Trifluoroacetic acid
HPMC	Hydroxypropyl Methylcellulose	T _G	Glass transition temperature
AS-MG	Acetate Succinate MG	TGA	Thermogravimetric analysis
IPA	Isopropanol	THF	Tetrahydrofuran
LCMS	Liquid chromatography mass spectrometry	TLC	Thin layer chromatography
MeOH	Methanol	TRS	Total related substances
MIBK	Methyl isobutyl ketone	UPLC	Ultra performance liquid chromatography
min	Minute	XRPD	X-ray powder diffraction

Instrumentation and Methods

[0221] Unless otherwise indicated, the following instrumentation and methods were used in the working examples described herein.

X-ray Powder Diffraction (XRPD or PXRD)

[0222] Method A. XRPD analysis was performed with a Panalytical X'Pert3 Powder XRPD on a Si zero-background holder. The 2θ position was calibrated against Panalytical 640 Si powder standard. Details of the XRPD method used in the experiments are listed in Table 1.

Table 1

Parameters for Reflection Mode	
X-Ray wavelength	Cu, $k\alpha$, $K\alpha_1$ (Å): 1.540598, $K\alpha_2$ (Å): 1.544426 $K\alpha_2/K\alpha_1$ intensity ratio: 0.50
X-Ray tube setting	45 kV, 40 mA
Divergence slit	Automatic
Scan mode	Continuous
Scan range ($^{\circ}2\theta$)	3° - 40°
Step size ($^{\circ}2\theta$)	0.0262606
Scan speed ($^{\circ}/s$)	0.066482

[0223] Method B. XRPD analysis was performed with a Rigaku X-Ray Powder Diffractometer MiniFlex 600 with the parameters listed in Table 2.

Table 2

Parameter	Setting
Soller (inc.)	5.0 deg
IHS	10.0 mm
SS	1.250 deg
DS	1.250 deg
Soller (rec)	5.0 deg
RS	0.3 mm
Scan Axis	Theta/2-Theta
Mode	Continuous
Start (deg)	2.0000
Stop (deg)	40.0000
Step (deg)	0.020
Speed (deg/min)	2.5

Parameter	Setting
Spin	Yes
Voltage (kV)	40
Current (mA)	15

[0224] Method C. XRPD analysis was performed with a Panalytical X'Pert3 powder diffractometer in reflection mode. Details of the XRPD method used in the experiments are as follows:

Parameters	
X-Ray wavelength	CuK α , K α 1 (Å): 1.540598, K α 2 (Å): 1.544426 K α 2/K α 1 intensity ratio: 0.50
X-Ray tube setting	45 kV, 40 mA
Divergence slit (°)	1/8
Scan mode	Continuous
Scan range (°2TH)	3° - 40°
Scan step time (s)	46.665
Step size (°2TH)	0.0263
Test time	~ 5 min

[0225] Method D. XRPD analysis was performed with the following parameters:

Parameters	
Start position (°2TH)	2.00
Stop position (°2TH)	40.00
DS (°)	1.250
RS (mm)	0.3
SS (°)	1.250
Step size (°)	0.02
Rate (°/minute)	0.50

Thermal Analysis (TGA and DSC)

[0226] Method A. TGA was conducted using a TA Q500 TGA from TA Instruments. DSC was performed using a TA Q2000 DSC from TA Instruments. Detailed parameters used are listed in Table 3.

Table 3

Parameters	TGA	DSC
Method	Ramp	Ramp
Sample pan	Platinum, open	Aluminum, crimped
Temperature	RT - desired temperature	25 °C - desired temperature
Heating rate	10 °C/min	10 °C/min
Purge gas	N ₂	N ₂

[0227] Method B. DSC analysis was conducted with the following procedure: Perform DSC modulated 1.00°C for 60 seconds with a ramp rate of 2°C/min to 250°C. Use a standby temperature range of 20° to 25°C.

Dynamic Vapor Sorption

[0228] Dynamic Vapor Sorption (DVS) was measured with a Surface Measurement System (SMS) DVS Intrinsic. Parameters for DVS analysis are listed in Table 4.

Table 4

Parameters	Values
Temperature	25 °C
Sample size	10-20 mg
Gas and flow rate	N ₂ , 200 mL/min
dm/dt	0.002%/min
Min. dm/dt stability duration	10 min
Max. equilibrium time	360 min
RH range	Room RH-95%RH-0%RH-95%RH
RH step size	10%

High-pressure Liquid Chromatography (HPLC)

[0229] Method A. The HPLC parameters and gradient set forth in Tables 5 and 6, respectively, were used for sample analysis.

Table 5

Parameter	Condition
HPLC System	Waters Alliance HPLC equipped with UV Detector
Column	Agilent ZORBAX StableBond-Aq, 4.6x 150mm, 3.5µm, Part No. 863953-914
Column Temperature	40.0 ± 3.0°C
Sample Temperature	Ambient
Detection Wavelength	210nm
Diluent	25:75 Water:ACN (v/v)
Mobile Phase A	[90:10] 20mM NaH ₂ PO ₄ · H ₂ O, pH 2.0 : ACN (v/v)
Mobile Phase B	[20:80] 20mM NaH ₂ PO ₄ · H ₂ O, pH 2.0 : ACN (v/v)
Needle Wash	50:50 MeOH: Water (v/v)
Seal Wash/ Purge	10:90 MeOH: Water (v/v)
Injection Volume	20 µL

Table 6

Time (Minutes)	Flow Rate (mL/min)	% Mobile Phase A	% Mobile Phase B
0.0	1.0	100.0	0.0
5.0	1.0	80.0	20.0
18.0	1.0	40.0	60.0
20.0	1.0	0.0	100.0
24.0	1.0	0.0	100.0
25.0	1.0	100.0	0.0
35.0	1.0	100.0	0.0

Ultra Performance Liquid Chromatography

[0230] The UPLC parameters and linear method gradients disclosed in Table 7 and Table 8, respectively, were used for sample analysis.

Table 7

Parameter	Condition
System	Waters H-Class UPLC with TUV detector
Column	Acquity UPLC BEH Shield RP18, 2.1 x 50 mm, 1.7 µm
Column Temperature	40.0 ± 3.0°C
Sample Temperature	Ambient
Mobile Phase A	0.1% Phosphoric Acid in [90:10] Water:ACN
Mobile Phase B / Needle Wash	0.1% Phosphoric Acid in ACN
Flow Rate	0.500 mL/min
Gradient	See Table 8
Injection Volume	2.0 µL

Parameter	Condition
Run Time	6.50 minutes
Detection Wavelength	293 nm
Sampling Rate	20 points/sec

Table 8

Time (Minutes)	Flow Rate (mL/min)	% Mobile Phase A	% Mobile Phase B
0.00	0.500	100.0	0.0
1.00	0.500	100.0	0.0
3.50	0.500	0.0	100.0
4.00	0.500	0.0	100.0
4.01	0.500	100.0	0.0
6.50	0.500	100.0	0.0

Water Content

[0231] Water content was determined by USP <921>, Method 1c.

Dissolution

[0232] Except where otherwise indicated, dissolution of the tablets is performed with USP Apparatus 2 (paddles) by USP<711>. The determination of assay is achieved by quantitation against an external reference standard using a reversed phase gradient UPLC method. The UPLC method utilizes an Acquity UPLC BEH Shield column with two mobile phases, both consisting of acetonitrile, water, and phosphate buffer..

Example 1 - Synthesis of (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-

1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one (1)

[0233] The PKR Activating Compound 1 can be obtained by the method described herein and the reaction schemes shown in Figures 1 and 2. Compound 1 has a molecular weight of 457.50 Da.

Step 1. 2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl chloride (3)

[0234] Into a 100 mL round-bottom flask purged and maintained with an inert atmosphere of nitrogen was placed a solution of *n*-BuLi in hexane (2.5 M, 2 mL, 5.0 mmol, 0.54 equiv) and a solution of *n*-Bu₂Mg in heptanes (1.0 M, 4.8 mL, 4.8 mmol, 0.53 equiv). The resulting solution

was stirred for 10 min at RT (20 °C). This was followed by the dropwise addition of a solution of 7-bromo-2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine (2 g, 9.26 mmol, 1.00 equiv) in tetrahydrofuran (16 mL) with stirring at -10 °C in 10 min. The resulting mixture was stirred for 1 h at -10 °C. The reaction mixture was slowly added to a solution of sulfonyl chloride (16 mL) at -10 °C. The resulting mixture was stirred for 0.5 h at -10 °C. The reaction was then quenched by the careful addition of 30 mL of saturated ammonium chloride solution at 0 °C. The resulting mixture was extracted with 3x50 mL of dichloromethane. The organic layers were combined, dried over anhydrous sodium sulfate, filtered and concentrated under vacuum. The residue was purified by silica gel column chromatography, eluting with ethyl acetate/petroleum ether (1:3). This provided 1.3 g (60%) of 2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl chloride as a white solid. LCMS *m/z*: calculated for C₇H₆ClNO₄S: 235.64; found: 236 [M+H]⁺.

Step 2. tert-Butyl 5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrole-2-carboxylate (4)

[0235] Into a 100-mL round-bottom flask was placed 2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl chloride (1.3 g, 5.52 mmol, 1.00 equiv), *tert*-butyl 1*H*,2*H*,3*H*,4*H*,5*H*,6*H*-pyrrolo[3,4-*c*]pyrrole-2-carboxylate (1.16 g, 5.52 mmol), dichloromethane (40 mL), and triethylamine (1.39 g, 13.74 mmol, 2.49 equiv). The solution was stirred for 2 h at 20 °C, then diluted with 40 mL of water. The resulting mixture was extracted with 3x30 mL of dichloromethane. The organic layers were combined, dried over anhydrous sodium sulfate, filtered and concentrated under vacuum. The residue was purified by silica gel column chromatography, eluting with dichloromethane/methanol (10:1). This provided 1.2 g (53%) of *tert*-butyl 5-[2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl]-1*H*,2*H*,3*H*,4*H*,5*H*,6*H*-pyrrolo[3,4-*c*]pyrrole-2-carboxylate as a yellow solid. LCMS *m/z*: calculated for C₁₈H₂₃N₃O₆S: 409.46; found: 410 [M+H]⁺.

Step 3. 2-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrole (5)

[0236] Into a 100-mL round-bottom flask was placed *tert*-butyl 5-[2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl]-1*H*,2*H*,3*H*,4*H*,5*H*,6*H*-pyrrolo[3,4-*c*]pyrrole-2-carboxylate (1.2 g, 2.93 mmol, 1.00 equiv), dichloromethane (30 mL), and trifluoroacetic acid (6 mL). The solution was

stirred for 1 h at 20 °C. The resulting mixture was concentrated under vacuum. The residue was dissolved in 10 mL of methanol and the pH was adjusted to 8 with sodium bicarbonate (2 mol/L). The resulting solution was extracted with 3x10 mL of dichloromethane. The organic layers were combined, dried over anhydrous sodium sulfate, filtered and concentrated under vacuum. The crude product was purified by silica gel column chromatography, eluting with dichloromethane/methanol (10:1). This provided 650 mg (72%) of 2-[2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl]-1*H*,2*H*,3*H*,4*H*,5*H*,6*H*-pyrrolo[3,4-*c*]pyrrole as a yellow solid. LCMS *m/z*: calculated for C₁₃H₁₅N₃O₄S: 309.34; found: 310 [M+H]⁺.

Step 4. (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one (1) and (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one (2)

[0237] Into a 100 mL round-bottom flask was placed 2-[2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl]-1*H*,2*H*,3*H*,4*H*,5*H*,6*H*-pyrrolo[3,4-*c*]pyrrole (150 mg, 0.48 mmol, 1.00 equiv), 3-hydroxy-2-phenylpropanoic acid (97 mg, 0.58 mmol, 1.20 equiv), dichloromethane (10 mL), HATU (369 mg, 0.97 mmol, 2.00 equiv) and DIEA (188 mg, 1.46 mmol, 3.00 equiv). The resulting solution was stirred overnight at 20 °C. The reaction mixture was diluted with 20 mL of water and was then extracted with 3x20 mL of dichloromethane. The organic layers were combined, dried over anhydrous sodium sulfate, filtered and concentrated under vacuum. The residue was purified by prep-TLC eluted with dichloromethane/methanol (20:1) and further purified by prep-HPLC (Column: XBridge C18 OBD Prep Column, 100 Å, 5 µm, 19 mm x 250 mm; Mobile Phase A: water (10 mmol/L NH₄HCO₃), Mobile Phase B: MeCN; Gradient: 15% B to 45% B over 8 min; Flow rate: 20 mL/min; UV Detector: 254 nm). The two enantiomers were separated by prep-Chiral HPLC (Column, Daicel CHIRALPAK® IF, 2.0 cm x 25 cm, 5 µm; mobile phase A: DCM, phase B: MeOH (hold 60% MeOH over 15 min); Flow rate: 16 mL/min; Detector, UV 254 & 220 nm). This resulted in peak 1 (**2**, Rt: 8.47 min) 9.0 mg (4%) of (R)-1-(5-[2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl]-1*H*,2*H*,3*H*,4*H*,5*H*,6*H*-pyrrolo[3,4-*c*]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one as a yellow solid; and peak 2 (**1**, Rt: 11.83 min) 10.6 mg (5%) of (S)-1-(5-[2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl]-1*H*,2*H*,3*H*,4*H*,5*H*,6*H*-pyrrolo[3,4-*c*]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one as a yellow solid.

[0238] (1): ¹H NMR (400 MHz, DMSO-*d*₆) δ 8.13 (d, *J* = 2.0 Hz, 1H), 7.61 (d, *J* = 2.0 Hz, 1H), 7.31-7.20 (m, 5H), 4.75 (t, *J* = 5.2 Hz, 1H), 4.50-4.47 (m, 2H), 4.40-4.36 (m, 1H), 4.32-4.29 (m, 2H), 4.11-3.87 (m, 8H), 3.80-3.77 (m, 1H), 3.44-3.41 (m, 1H). LC-MS (ESI) *m/z*: calculated for C₂₂H₂₃N₃O₆S: 457.13; found: 458.0 [M+H]⁺.

[0239] (2): ¹H NMR (400 MHz, DMSO-*d*₆) δ 8.13 (d, *J* = 2.0 Hz, 1H), 7.60 (d, *J* = 2.0 Hz, 1H), 7.31-7.18 (m, 5H), 4.75 (t, *J* = 5.2 Hz, 1H), 4.52-4.45 (m, 2H), 4.40-4.36 (m, 1H), 4.34-4.26 (m, 2H), 4.11-3.87 (m, 8H), 3.80-3.78 (m, 1H), 3.44-3.43 (m, 1H). LC-MS (ESI) *m/z*: calculated for C₂₂H₂₃N₃O₆S: 457.13; found: 458.0 [M+H]⁺.

*Step 5. (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-*c*]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one (1)*

[0240] Alternatively, Compound **1** can be synthesized using the procedure described here as Step 5.

[0241] 3-Hydroxy-2-phenylpropanoic acid (1 g) was separated by Prep-SFC with the following conditions: Instrument Name: SHIMADZU LC-20AD, LC parameters: Pump Mode: Binary gradient, Start Conc. of Pump B: 100.0%, Total Flow: 170 mL/min, Phase A, Phase B: MeOH (0.1% HAC), Column Name: CHIRALPAK AD-H, Length: 100 mm, Internal Diameter: 4.6 mm, Particle Size: 5 μm, Column Temp: 20 °C, PDA Model: SPD-M20A, Wavelength: from 190 nm to 500 nm. This provided peak 1: (R_t = 5.76 min) 380 mg of (*S*)-3-hydroxy-2-phenylpropanoic acid as a white solid, and peak 2: (R_t = 6.87min) 370 mg of (*R*)-3-hydroxy-2-phenylpropanoic acid as a white solid. ¹H NMR (300MHz, DMSO-*d*₆): δ ppm 12.31 (br s, 1H), 7.40-7.20 (m, 5H), 4.94 (br s, 1H), 3.92 (t, *J* = 9 Hz, 1H), 3.67-3.54 (m, 2H). *S*-enantiomer : α_D^{16.7} = -110 (C 0.02, water); [literature: -79] *R*-enantiomer : α_D^{16.7} = +125 (C 0.02, water).

[0242] A solution of 7-((3,4,5,6-tetrahydropyrrolo[3,4-*c*]pyrrol-2(1*H*)-yl)sulfonyl)-2,3-dihydro-[1,4]dioxino[2,3-*b*]pyridine (130.9 mg, 0.423 mmol) in DMF (2.5 ml) was cooled on an ice bath, then treated with (*S*)-3-hydroxy-2-phenylpropanoic acid (84.8 mg, 0.510 mmol), HATU (195.5 mg, 0.514 mmol), and DIEA (0.30 mL, 1.718 mmol) and stirred at ambient temperature overnight. The solution was diluted with EtOAc (20 mL), washed sequentially with water (20 mL) and brine (2x20 mL), dried (MgSO₄), filtered, treated with silica gel, and evaporated under reduced

pressure. The material was chromatographed by Biotage MPLC (10 g silica gel column, 0 to 5% MeOH in DCM) to provide a white, slightly sticky solid. The sample was readsorbed onto silica gel and chromatographed (10 g silica gel column, 0 to 100% EtOAc in hexanes) to provide (2*S*)-1-(5-[2*H*,3*H*-[1,4]dioxino[2,3-*b*]pyridine-7-sulfonyl]-1*H*,2*H*,3*H*,4*H*,5*H*,6*H*-pyrrolo[3,4-*c*]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one (106.5 mg, 0.233 mmol, 55 % yield) as a white solid.

Example 2- Preparation and Characterization of Type A of Compound 1

Preparation of Type A of Compound 1

[0243] A 1L round-bottom flask with overhead stirring, a temperature probe, and an N₂ inlet was charged with 7-((3,4,5,6-tetrahydropyrrolo[3,4-*c*]pyrrol-2(1*H*)-yl)sulfonyl)-2,3-dihydro-[1,4]dioxino[2,3-*b*]pyridine (33.24 g, 96 mmol), (S)-3-hydroxy-2-phenylpropanoic acid (19.08 g, 115 mmol), and DMF (361 ml). The mixture was cooled to 0 °C, HATU (43.7 g, 115 mmol) was added, and a mild ~ 5 °C exotherm was observed. DIEA (70.2 ml, 402 mmol) was added dropwise over 20 minutes, and the pot was held near 0 °C. The reaction mixture was sampled after 2h and then after 3h. After 3h, an additional 50mL of DMF was added to thin the reaction mixture.

[0244] After 3.5h at 0 °C, 37 volumes of DCM was added to the reaction mixture, and the solution was transferred to a 4L separatory funnel and washed with water (2060mL). The organic layer was then washed 3 X 2060mL of brine (26% W/W NaCl) and dried overnight with MgSO₄. The solution was concentrated on a rotary evaporator to afford a waxy white solid (>80g).

[0245] The solids were triturated with 500 mL of 5:4 EtOAc/hexanes, filtered, washed with 100 mL of 1:1 EtOAc/Hexanes, and dried in a vacuum oven at ambient temperature to afford 50.3 g of a white solid.

[0246] The resulting material was ground in a mortar, charged to a 3 L round-bottom flask with overhead stirring and slurried with 1900 mL of ethanol. The slurry was heated to 76 °C, and water was added dropwise. After 40 mL of water had added, the mixture was filtered with a Buchner funnel. The filtrate was charged back to the round-bottom flask, stirred overnight, and cooled slowly to room temperature.

[0247] The resulting slurry was cooled to 10 °C, stirred for 1 h, and filtered. The round-bottom flask and filter cake were washed with 100 mL of ethanol. The filter cake was dried on the funnel for 1 h, and overnight in a vacuum oven at ambient temperature to afford 38.43 g of Compound 1 a white solid, which was designated as Type A of Compound 1.

Characterization of Type A of Compound 1

[0248] Type A was characterized by XRPD (Method A), TGA (Method A), DSC (Method A), and DVS analysis.

[0249] The XRPD pattern for Type A is depicted in Figure 3, and the corresponding data are summarized in the following table:

Pos. [°2Th.]	d-spacing [Å]
4.61	19.19
5.80	15.24
7.22	12.25
7.68	11.50
11.21	7.89
12.31	7.19
14.44	6.13
15.66	5.66
16.95	5.23
18.02	4.92
19.20	4.62
20.48	4.34
21.35	4.16
21.66	4.10
22.47	3.96
23.19	3.84
24.76	3.60
26.73	3.34
28.01	3.19
28.49	3.13
29.35	3.04
30.25	2.95
32.14	2.79
34.12	2.63
36.46	2.46

[0250] The foregoing XRPD data for Type A can also be rounded to a single decimal place, as summarized in the following table:

Pos. [°2Th.]	d-spacing [Å]
4.6	19.2
5.8	15.2
7.2	12.2

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
7.7	11.5
11.2	7.9
12.3	7.2
14.4	6.1
15.7	5.7
16.9	5.2
18.0	4.9
19.2	4.6
20.5	4.3
21.3	4.2
21.7	4.1
22.5	4.0
23.2	3.8
24.8	3.6
26.7	3.3
28.0	3.2
28.5	3.1
29.4	3.0
30.3	3.0
32.1	2.8
34.1	2.6
36.5	2.5

[0251] The TGA and DSC curves for Type A are shown in Figure 4. As shown in Figure 4, Type A showed 1.9% weight loss up to 100 °C by TGA and two endotherms at 85.9 °C (peak temperature) and 146.0 °C (onset temperature) by DSC.

[0252] By DSC cycling as shown in Figure 5, Type A was heated to 120°C and cooled to 25°C, then heated up to 300°C. No endotherm below 100°C was observed in the second heating cycle. XRPD analysis after DSC cycling showed no form change compared to Type A (Figure 3).

[0253] DVS results showed a 3.4% water uptake up to 40% RH (ambient condition), and 1.0% water uptake from 40% RH to 80%RH at RT, indicating that Type A is hygroscopic (Figure 6). No form change was observed for Type A before and after DVS test at RT, as determined by XRPD.

[0254] Based on the foregoing analytical data, Type A is believed to be a channel hydrate.

Example 3- Polymorph Screening of Compound 1

[0255] Polymorph screening experiments were performed using a series of crystallization and solid transition methods.

Solid Vapor Diffusion

[0256] Solid vapor diffusion experiments were conducted using 13 different solvents. Approximately 15 mg of Compound 1 (Type A) was weighed into a 4-mL vial, which was placed into a 20-mL vial with 3 mL of volatile solvent. The 20-mL vial was sealed with a cap and kept at RT for 7 days, allowing solvent vapor to interact with the sample. The solids were characterized by XRPD analysis (Method A), and the results summarized in Table 9 showed that Type A or a mixture of Types A and D were obtained.

Table 9

Solvent	Solid Form
H ₂ O	Type A
EtOH	Type A
Toluene	Type A
Acetone	Type A
ACN	Type A
DCM	Type A
THF	Type D + Type A
CHCl ₃	Type A
MeOH	Type A
IPA	Type A
1,4-Dioxane	Type A
DMSO	Type A
EtOAc	Type A

Slurry Conversion at 4°C, RT or 50 °C

[0257] Slurry experiments were conducted at RT in different solvent systems. About 15 mg of Compound 1 (Type A) was suspended in 0.3 mL of solvent in a 2-mL glass vial. After the suspension was stirred magnetically for 7 days at 4°C, RT or 50 °C, the remaining solids were

isolated for XRPD analysis (Method A). Results summarized in Table 10 indicated that Type A, B, C and D, or mixtures thereof, were obtained.

Table 10

Solvent (v:v)	Temperature (°C)	Solid Form
H ₂ O	50 °C	Type B
MeOH		Type B
EtOAc		Type A
MIBK		Type A
Toluene		Type A
Acetone	RT	Type A
1,4-Dioxane		Type C
DMSO/H ₂ O (1/9)		Type B
THF	4 °C	Type D
ACN		Type A
CHCl ₃ /Toluene (1/3)		Type B + Type A
DCM/n-Heptane (1/3)		Type A
EtOH	50 °C	Type A
IPA		Type A
IPAc		Type A
MTBE		Type A
n-Heptane		Type A
2-MeTHF		Type A
1,4-Dioxane		Type A
THF		Type A
CHCl ₃ /MeOH (v/v, 1:3)		Type A
Acetone / H ₂ O (v/v, 1:3)		Type B
CHCl ₃ / EtOAc (v/v, 1:3)		Type A
ACN / IPA (v/v, 1:3)		Type A
Acetone / IPAc (v/v, 1:3)		Type A
DCM / EtOH (v/v, 1:3)		Type A
1,4-Dioxane/MeOH (v/v, 1:1)		Type A

Solvent (v:v)	Temperature (°C)	Solid Form
1,4-Dioxane/Toluene (v/v, 1:1)		Type A

Liquid Vapor Diffusion

[0258] Approximately 15 mg of Compound **1** (Type A) was dissolved in an appropriate solvent to obtain a clear solution in a 4-mL vial. This solution was then placed into a 20-mL vial with 3 mL of anti-solvent. The 20-mL vial was sealed with a cap and kept at RT, allowing sufficient time for organic vapor to interact with the solution. After 7 days, solids were isolated for XRPD analysis (Method A). The results summarized in Table 11 showed that Type A and B were generated.

Table 11

Solvent	Anti-solvent	Solid Form
THF	MeOH	Type A
	EtOAc	Type A
1,4-Dioxane	Toluene	Type A
	MTBE	Type A
1,4-Dioxane	MeOH	Type B
	EtOAc	Type A
	n-Heptane	Type F
Acetone	H ₂ O	Type B
	IPA	Type A
	MIBK	Type A
CHCl ₃	EtOH	Type A
	2-MeTHF	Type A
	IPAc	Type A

[0259] Another series of liquid vapor diffusion experiments was performed under the conditions set forth in Table 12. Compound **1** (Type A) was weighed into a 3 mL glass vial with the addition of the corresponding solvent or solvent mixture. After being vortexed and ultrasonically shaken, the suspension was filtered, and the filtrate was transferred to a clean 4 mL shell vial. A small amount of Compound **1** (Type A) was added as a seed crystal. Subsequently, the shell vial was sealed with a polyethylene plug with one pinhole and enclosed in a 20 mL glass

vial containing 3 mL of the anti-solvent at room temperature for liquid vapor diffusion. The solid forms resulting from the experiments were characterized by XRPD analysis (Method C).

Table 12

Amount of Compound 1 (mg)	Solvent	Solvent Volume (mL)	Anti-Solvent	Solid Form
3.0	MeOH	0.5	MTBE	Type B
10.0	ACN	0.5	MTBE	Type B
10.1	ACN	0.5	H ₂ O	Type B
34.3	CHCl ₃	0.3	n-pentane	Type A
4.9	Acetone	0.5	MTBE	Type A
17.5	1,4-dioxane	0.5	H ₂ O	Clear solution
17.6	1,4-dioxane	0.5	n-heptane	Type A
11.5	THF	0.5	MeOH	Type D
12.1	THF	0.5	EtOAc	Type M
10.4	THF	0.5	n-pentane	Type D
31.9	DMSO	0.2	H ₂ O	Type A
10.8	DMSO	0.1	IPA	Type A
32.1	DMF	0.2	Toluene	Type H
10.9	DMF	0.1	IPAc	Type I
30.8	NMP	0.2	MTBE	Type J
10.3	NMP	0.1	H ₂ O	Clear solution

Slow Evaporation

[0260] Slow evaporation experiments were performed under 4 conditions. Briefly, about 15 mg of Compound 1 (Type A) was mixed with 1.0-2.5 mL of solvent in a 4-mL glass vial. If the solids were not dissolved completely, suspensions were filtered using a PTFE membrane (pore size of 0.2 μ m) and the filtrates were used for the follow-up steps. The visually clear solutions were subjected to evaporation at RT with vials sealed by Parafilm[®] (3-5 pinholes). The solids were isolated for XRPD analysis (Method A), and the results summarized in Table 13 indicated that only Type A was obtained.

Table 13

Solvent	Solid Form
Acetone	Type A
THF	Type A
CHCl ₃	Type A
DCM	Type A

[0261] Another series of slow evaporation experiments was performed under the conditions set forth in Table 14. Compound **1** (Type A) was weighed into a 3 mL glass vial with the addition of the corresponding solvent or solvent mixture. After being vortexed and ultrasonically shaken, the suspension was filtered, and the filtrate was transferred to a clean 4 mL shell vial. A small amount of Compound **1** (Type A) was added as a seed crystal. Subsequently, the shell vial was sealed with a polyethylene plug with one pinhole and placed in a fume hood at room temperature for slow evaporation. The solid forms resulting from the experiments were characterized by XRPD analysis (Method C).

Table 14

Amount of Compound 1 (mg)	Solvent	Solvent Volume (mL)	Solid Form
3.0	MeOH	1.0	Type B
3.2	EtOAc	1.0	Type B
10.0	ACN	0.5	Type B
4.6	Acetone	0.5	Type A
10.1	THF	0.5	Type D
5.2	MeOH/Acetone (1:1 v/v)	0.5	Type B
3.2	EtOAc/2-MeTHF (1:1 v/v)	0.5	Type B
4.5	Acetone/EtOH (1:1 v/v)	0.5	Type A
4.7	Acetone/EtOAc (1:1 v/v)	0.5	Type A
13.0	Acetone/H ₂ O (5:1 v/v)	0.5	Type B
13.8	ACN/EtOH (1:1 v/v)	0.5	Type A
17.3	ACN/IPA (4:1 v/v)	0.5	Type A
11.1	ACN/EtOAc (1:1 v/v)	0.5	Type A
5.0	ACN/MIBK (1:1 v/v)	0.5	Type A

Amount of Compound 1 (mg)	Solvent	Solvent Volume (mL)	Solid Form
14.4	ACN/2-MeTHF (1:1 v/v)	0.5	Type A
27.7	ACN/n-heptane (10:1 v/v)	0.5	Type B
9.8	ACN/H ₂ O (5:1 v/v)	0.5	Type B
7.3	DCM/IPAc (1:1 v/v)	0.5	Type A
10.8	DCM/n-heptane (1:1 v/v)	0.5	Type A
22.7	CHCl ₃ /IPA (1:1 v/v)	0.5	Type A
22.9	CHCl ₃ /toluene (1:1 v/v)	0.5	Type A
10.7	THF/EtOH (1:1 v/v)	0.5	Type A
9.6	THF/H ₂ O (5:1 v/v)	0.5	Type B
32.9	1,4-dioxane/H ₂ O (4:1 v/v)	0.5	Gel

Anti-solvent Addition

[0262] A total of 8 anti-solvent addition experiments were carried out. About 15 mg of Compound 1 (Type A) was dissolved in 0.2-4.0 mL of solvent to obtain a clear solution. The solution was magnetically stirred followed by addition of 0.2 mL anti-solvent per step until precipitate appeared or the total amount of anti-solvent reached 15.0 mL. The obtained precipitate was isolated for XRPD analysis (Method A). Results in Table 15 showed that Type A and amorphous material were generated.

Table 15

Solvent/Anti-solvent	Solid Form
DMSO/H ₂ O	Type A + Amorphous
CHCl ₃ /Heptane	Amorphous
DMSO/MeOH	Amorphous
Acetone/H ₂ O	Amorphous
DMAc/IPA	Amorphous
ACN/EtOH	Type A + Amorphous
CHCl ₃ /Toluene	Amorphous
DCM/Heptane	Amorphous

Reverse anti-solvent addition

[0263] A total of 2 reverse anti-solvent addition experiments were carried out. About 15 mg of Compound 1 (type A) was dissolved in 0.2 mL solvent to obtain a clear solution. The solution was added into 2 mL anti-solvent. The obtained precipitate was isolated for XRPD analysis (Method A). Results summarized in Table 16 indicated Type A or a mixture of Type A and amorphous material were generated.

Table 16

Solvent/Anti-solvent	Solid Form
DMSO/H ₂ O	Type A + Amorphous
CHCl ₃ /Heptane	Type A

Slow Cooling

[0264] Slow cooling experiments were performed under the conditions set forth in Table 17. Compound 1 (Type A) was weighed into a 3 mL glass vial with the addition of the corresponding solvent or solvent mixture. After being vortexed and ultrasonically shaken to accelerate dissolution, the suspension was placed in a biochemical incubator and equilibrated at 50 °C for 30 minutes. The hot suspension was then filtered with a syringe filter (0.045 µm PTFE filter membrane, and the hot filtrate was transferred to a clean 3 mL vial (pre-heated at 50 °C). The vial was sealed and placed in an incubator for slow cooling from 50 °C to 5 °C at a rate of 0.01 °C/minute. The solid forms resulting from the experiments were characterized by XRPD analysis (Method C).

Table 17

Amount of Compound 1 (mg)	Solvent	Solvent Volume (mL)	Solid Form
20.5	MeOH	1.5	Type B
15.7	EtOH	1.5	Type A
20.3	EtOAc	1.5	Type B
14.9	MIBK	1.5	Clear solution
15.4	2-MeTHF	1.5	Type K
40.3	ACN/H ₂ O (2:1 v/v)	0.8	Type B

Amount of Compound 1 (mg)	Solvent	Solvent Volume (mL)	Solid Form
40.6	Acetone/H ₂ O (2:1 v/v)	1.0	Type B
40.3	Acetone/n-heptane (3:1 v/v)	1.0	Type A
40.4	1,4-dioxane/H ₂ O (1:1 v/v)	1.0	Type B
39.7	THF/H ₂ O (1:1 v/v)*	1.0	Type L

*After slow cooling, only a few small crystals were observed. System was kept at 5 °C for 22 days, at which time plate crystals (Type L) were observed.

Example 4- Preparation and Characterization of Type B of Compound 1

Preparation of Type B of Compound 1

[0265] Type B was prepared on a 100mg scale from a slurry of Type A in methanol at 50 °C, via a method analogous to the method for slurry conversion described in Example 3.

Characterization of Type B of Compound 1

[0266] Type B was characterized by XRPD (Method A), TGA (Method A), DSC (Method A), and DVS analysis.

[0267] The XRPD pattern for Type B is depicted in Figure 7, and the corresponding data are summarized in the following table:

Pos. [°2Th.]	d-spacing [Å]
4.52	19.53
8.98	9.85
9.86	8.97
12.37	7.15
13.18	6.72
15.57	5.69
16.86	5.26
18.21	4.87
19.11	4.64
19.93	4.45
20.92	4.25
22.19	4.00
22.89	3.89
23.34	3.81
25.13	3.54
25.80	3.45
26.71	3.34
28.30	3.15

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
29.39	3.04

[0268] The foregoing XRPD data for Type B can also be rounded to a single decimal place, as summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
4.5	19.5
9.0	9.9
9.9	9.0
12.4	7.2
13.2	6.7
15.6	5.7
16.9	5.3
18.2	4.9
19.1	4.6
19.9	4.5
20.9	4.2
22.2	4.0
22.9	3.9
23.3	3.8
25.1	3.5
25.8	3.5
26.7	3.3
28.3	3.2
29.4	3.0

[0269] The TGA and DSC curves for Type B are shown in Figure 8. As shown in Figure 8, Type B showed 1.8% weight loss up to 100 $^{\circ}\text{C}$ and an endotherm at 138.2 $^{\circ}\text{C}$ (onset temperature) possibly due to melting.

[0270] By DSC cycling (RT- 120 $^{\circ}\text{C}$ - RT - 250 $^{\circ}\text{C}$) as shown in Figure 9, only one melting endotherm at 139.2 $^{\circ}\text{C}$ (onset temperature) was observed, with no broad endotherm below 120 $^{\circ}\text{C}$ in the second heating cycle.

[0271] As shown in Figure 10, Type B showed a 1.7% weight loss up to 120 $^{\circ}\text{C}$ by instant TGA test after heating to 120 $^{\circ}\text{C}$ and exposing to ambient condition for only one minute. The normal TGA curve of Type B showed 2.3% weight loss up 120 $^{\circ}\text{C}$ without pre-heating treatment.

[0272] After heating to 120 $^{\circ}\text{C}$ and cooling to RT by DSC cycling, no form change was observed by XRPD analysis.

[0273] By DVS analysis (Figure 11), Type B showed a 2.9% water uptake up to 60% RH (ambient condition), and 0.4% water uptake from 60% RH to 80%RH at RT, indicating that Type B is hygroscopic. No form change was observed for Type B before and after DVS test at RT, as determined by XRPD analysis.

[0274] Based on the foregoing analytical data, Type B is believed to be a channel hydrate.

Example 5- Preparation and Characterization of Type C of Compound 1

Preparation of Type C of Compound 1

[0275] Type C was prepared on a 100 mg scale from a slurry of Type A in 1,4-Dioxane at RT, via a method analogous to the method for slurry conversion described in Example 3.

Characterization of Type C of Compound 1

[0276] Type C was characterized by XRPD (Method A), TGA (Method A), DSC (Method A), and DVS analysis.

[0277] The XRPD pattern for Type C is depicted in Figure 12, and the corresponding data are summarized in the following table:

Pos. [°2Th.]	d-spacing [Å]
4.55	19.43
7.34	12.05
9.07	9.75
11.17	7.92
12.29	7.20
14.51	6.11
15.66	5.66
18.34	4.84
18.85	4.71
19.57	4.54
20.38	4.36
21.66	4.10
23.02	3.86
24.65	3.61
26.39	3.38
28.28	3.16
30.09	2.97
32.31	2.77
33.91	2.64

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
37.19	2.42

[0278] The foregoing XRPD data for Type C can also be rounded to a single decimal place, as summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
4.5	19.4
7.3	12.0
9.1	9.7
11.2	7.9
12.3	7.2
14.5	6.1
15.7	5.7
18.3	4.8
18.9	4.7
19.6	4.5
20.4	4.4
21.7	4.1
23.0	3.9
24.7	3.6
26.4	3.4
28.3	3.2
30.1	3.0
32.3	2.8
33.9	2.6
37.2	2.4

[0279] The TGA and DSC curves for Type C are shown in Figure 13. As shown in Figure 13, Type C showed 1.0% weight loss up to 100 $^{\circ}\text{C}$ and an endotherm at 152.2 $^{\circ}\text{C}$ (onset temperature) possibly due to melting.

[0280] By using DSC cycling (RT-120 $^{\circ}\text{C}$ - RT- 250 $^{\circ}\text{C}$), only a melting endotherm at 154.2 $^{\circ}\text{C}$ (onset temperature) was observed, with no broad endotherm below 120 $^{\circ}\text{C}$ in the second heating cycle (Figure 14).

[0281] As shown in Figure 15, Type C showed a 0.7% weight loss up to 130 $^{\circ}\text{C}$ by instant TGA test after heating to 120 $^{\circ}\text{C}$ and exposing to ambient conditions for one minute. The normal TGA curve of the Type C showed 2.3% weight loss up 130 $^{\circ}\text{C}$ without pre-heating treatment.

[0282] After heating to 120 °C and cooling to RT by DSC cycling, no form change was observed by XRPD analysis.

[0283] By DVS analysis (Figure 16), Type C showed a 1.8% water uptake up to 60% RH (ambient condition), and 0.5% water uptake from 60% RH to 80%RH at RT, indicating that Type C is hygroscopic. No form change was observed for Type C before and after DVS test at RT, as determined by XRPD analysis.

[0284] Based on the foregoing analytical data, Type B is believed to be a channel hydrate.

Example 6- Preparation and Characterization of Type D of Compound 1

Preparation of Type D of Compound 1

[0285] Type D was prepared from a slurry of Type A in Tetrahydrofuran (THF) at 4 °C, via a method analogous to the method for slurry conversion described in Example 3.

Characterization of Type D of Compound 1

[0286] Type D was characterized by XRPD (Method A), TGA (Method A), DSC (Method A), and ¹H NMR analysis.

[0287] The XRPD pattern for Type D is depicted in Figure 17, and the corresponding data are summarized in the following table:

Pos. [°2Th.]	d-spacing [Å]
4.27	20.68
6.15	14.36
8.71	10.16
9.72	9.10
12.31	7.19
13.08	6.77
13.76	6.44
15.74	5.63
18.02	4.92
19.55	4.54
21.90	4.06
23.59	3.77
24.79	3.59
26.71	3.34
29.50	3.03
30.82	2.90
31.74	2.82

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
35.40	2.54
37.84	2.38
38.61	2.33

[0288] The foregoing XRPD data for Type D can also be rounded to a single decimal place, as summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
4.3	20.7
6.2	14.4
8.7	10.2
9.7	9.1
12.3	7.2
13.1	6.8
13.8	6.4
15.7	5.6
18.0	4.9
19.5	4.5
21.9	4.1
23.6	3.8
24.8	3.6
26.7	3.3
29.5	3.0
30.8	2.9
31.7	2.8
35.4	2.5
37.8	2.4
38.6	2.3

[0289] The TGA and DSC curves for Type D are shown in Figure 18. As shown in Figure 18, Type D showed 9.6% weight loss up to 130 $^{\circ}\text{C}$ by TGA and an endotherm at 91.9 $^{\circ}\text{C}$ (onset temperature) by DSC.

[0290] The ^1H NMR spectra of Type A and Type D are shown in Figure 19. Type D appears to be a THF solvate, as indicated by the ^1H NMR spectrum (600 MHz, DMSO- d_6), which detected the presence of THF protons at ~ 1.76 and $\sim 3.60\text{ppm}$.

Example 7- Preparation and Characterization of Type E of Compound 1*Characterization of Type E of Compound 1*

[0291] Type E was characterized by XRPD (Method A) analysis.

[0292] The XRPD pattern for Type E is depicted in Figure 20, and the corresponding data are summarized in the following table:

Pos. [°2Th.]	d-spacing [Å]
4.59	19.27
8.76	10.09
9.76	9.06
12.36	7.16
13.12	6.75
13.83	6.40
15.12	5.86
15.75	5.63
16.84	5.27
17.48	5.07
18.06	4.91
19.02	4.67
20.05	4.43
21.93	4.05
23.18	3.84
23.70	3.75
24.82	3.59
26.72	3.34
27.81	3.21
29.51	3.03
30.76	2.91
31.74	2.82
33.03	2.71
34.52	2.60
35.39	2.54
36.72	2.45
37.77	2.38
38.66	2.33

[0293] The foregoing XRPD data for Type E can also be rounded to a single decimal place, as summarized in the following table:

Pos. [°2Th.]	d-spacing [Å]
4.6	19.3

Pos. [$^{\circ}$ 2 θ .]	d-spacing [$\text{\AA}$]
8.8	10.1
9.8	9.1
12.4	7.2
13.1	6.7
13.8	6.4
15.1	5.9
15.8	5.6
16.8	5.3
17.5	5.1
18.1	4.9
19.0	4.7
20.0	4.4
21.9	4.1
23.2	3.8
23.7	3.8
24.8	3.6
26.7	3.3
27.8	3.2
29.5	3.0
30.8	2.9
31.7	2.8
33.0	2.7
34.5	2.6
35.4	2.5
36.7	2.4
37.8	2.4
38.7	2.3

Example 8- Preparation and Characterization of Type F of Compound 1

Preparation of Type F of Compound 1

[0294] Type F of Compound 1 was produced via liquid vapor diffusion in 1,4-Dioxane/heptane at RT.

Characterization of Type F of Compound 1

[0295] Type F was characterized by XRPD (Method A), TGA, and DSC analysis (Method A).

[0296] The XRPD pattern for Type F is shown in Figure 21, and the corresponding data are summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
5.45	16.23
10.92	8.10
12.87	6.88
14.66	6.04
16.00	5.54
16.79	5.28
17.36	5.11
18.99	4.67
20.01	4.44
20.57	4.32
21.36	4.16
22.45	3.96
23.25	3.83
25.32	3.52
26.57	3.35
27.25	3.27
27.97	3.19
30.02	2.98
31.98	2.80
32.89	2.72
38.29	2.35
39.09	2.30

[0297] The foregoing XRPD data for Type F can also be rounded to a single decimal place, as summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
5.4	16.2
10.9	8.1
12.9	6.9
14.7	6.0
16.0	5.5
16.8	5.3
17.4	5.1
19.0	4.7
20.0	4.4
20.6	4.3
21.4	4.2
22.5	4.0
23.2	3.8
25.3	3.5

Pos. [°2Th.]	d-spacing [Å]
26.6	3.4
27.2	3.3
28.0	3.2
30.0	3.0
32.0	2.8
32.9	2.7
38.3	2.4
39.1	2.3

[0298] The TGA and DSC curves for Type F are shown in Figure 22. As shown in Figure 22, Type F showed 6.2% weight loss up to 120 °C by TGA and two endotherms at 100.4°C and 125.9 °C (onset temperature) by DSC.

Example 9- Preparation and Characterization of Type G of Compound 1

Preparation of Type G of Compound 1

[0299] Type G was prepared from a slurry of Type A in methyl ethyl ketone at room temperature.

Characterization of Type G of Compound 1

[0300] Type G was characterized by XRPD (Method A) analysis.

[0301] The XRPD pattern for Type G is depicted in Figure 23, and the corresponding data are summarized in the following table:

Pos. [°2Th.]	d-spacing [Å]
5.36	16.48
8.73	10.13
12.83	6.90
14.34	6.18
15.00	5.91
15.79	5.61
16.58	5.35
18.54	4.79
19.78	4.49
21.35	4.16
22.35	3.98
23.38	3.80
25.33	3.52

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
26.43	3.37
27.35	3.26
30.21	2.96
32.32	2.77
38.04	2.37

[0302] The foregoing XRPD data for Type G can also be rounded to a single decimal place, as summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
5.4	16.5
8.7	10.1
12.8	6.9
14.3	6.2
15.0	5.9
15.8	5.6
16.6	5.3
18.5	4.8
19.8	4.5
21.3	4.2
22.3	4.0
23.4	3.8
25.3	3.5
26.4	3.4
27.4	3.3
30.2	3.0
32.3	2.8
38.0	2.4

Example 10 - Preparation and Characterization of Type H of Compound 1

Preparation of Type H of Compound 1

[0303] Type H was prepared by liquid vapor diffusion, as described in Example 3.

Characterization of Type H of Compound 1

[0304] Type H was characterized by XRPD (Method C) analysis.

[0305] The XRPD pattern for Type H is depicted in Figure 24 and the corresponding data are summarized in the following table:

Pos. [$^{\circ}$ 2 θ .]	d-spacing [$\text{\AA}$]
5.8	15.3
8.4	10.5
11.5	7.7
12.4	7.2
13.1	6.8
13.7	6.5
14.7	6.0
14.9	5.9
16.0	5.6
16.2	5.5
16.6	5.4
16.9	5.3
17.3	5.1
17.7	5.0
18.3	4.8
19.5	4.6
20.0	4.4
21.3	4.2
21.9	4.1
23.1	3.9
23.6	3.8
23.9	3.7
24.4	3.7
24.9	3.6
25.1	3.5
25.4	3.5
26.2	3.4
27.4	3.3
28.1	3.2
28.4	3.1
29.3	3.0
29.7	3.0
30.4	2.9
31.0	2.9
32.7	2.7
33.4	2.7
34.1	2.6
34.8	2.6
35.5	2.5
35.8	2.5
36.4	2.5
37.1	2.4

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
38.5	2.3

Example 11 - Preparation and Characterization of Type I of Compound 1

Preparation of Type I of Compound 1

[0306] Type I was prepared by liquid vapor diffusion, as described in Example 3.

Characterization of Type I of Compound 1

[0307] Type I was characterized by XRPD (Method C) analysis.

[0308] The XRPD pattern for Type I is depicted in Figure 25, and the corresponding data are summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
5.2	17.1
8.8	10.1
10.3	8.6
12.6	7.0
14.6	6.1
15.5	5.7
16.1	5.5
16.3	5.4
16.6	5.3
17.1	5.2
17.6	5.0
18.7	4.7
18.9	4.7
20.2	4.4
20.5	4.3
20.7	4.3
21.1	4.2
21.5	4.1
22.0	4.0
22.3	4.0
23.7	3.8
24.8	3.6
25.2	3.5
26.0	3.4
26.3	3.4
26.5	3.4
26.8	3.3

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
27.0	3.3
27.5	3.2
27.7	3.2
28.1	3.2
29.6	3.0
30.0	3.0
30.4	2.9
31.3	2.9
32.0	2.8
32.5	2.8
33.2	2.7
34.0	2.6
34.6	2.6
36.9	2.4
38.2	2.4
38.9	2.3
39.5	2.3

Example 12 - Preparation and Characterization of Type J of Compound 1

Preparation of Type J of Compound 1

[0309] Type J was prepared by liquid vapor diffusion, as described in Example 3.

Characterization of Type J of Compound 1

[0310] Type J was characterized by XRPD (Method C) analysis.

[0311] The XRPD pattern for Type J is depicted in Figure 26, and the corresponding data are summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
4.5	19.5
5.7	15.4
7.1	12.7
7.7	11.5
9.1	9.7
10.5	8.4
11.2	7.9
11.7	7.5
12.3	7.2
12.9	6.8
14.3	6.2

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
14.5	6.1
15.4	5.8
15.7	5.7
16.3	5.4
17.3	5.1
18.3	4.9
18.7	4.7
19.3	4.6
19.6	4.5
20.5	4.3
21.2	4.2
21.5	4.1
22.8	3.9
23.1	3.8
23.6	3.8
24.1	3.7
24.5	3.6
25.2	3.5
25.9	3.4
26.4	3.4
27.8	3.2
29.3	3.0
36.2	2.5
37.0	2.4

Example 13 - Preparation and Characterization of Type K of Compound 1

Preparation of Type K of Compound 1

[0312] Type K was prepared by slow cooling, as described in Example 3.

Characterization of Type K of Compound 1

[0313] Type K was characterized by XRPD (Method C) analysis.

[0314] The XRPD pattern for Type K is depicted in Figure 27, and the corresponding data are summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
4.6	19.2
9.3	9.5
10.1	8.7
12.9	6.8

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
13.9	6.4
14.7	6.0
15.4	5.7
15.6	5.7
16.1	5.5
17.8	5.0
18.3	4.9
18.6	4.8
19.3	4.6
20.0	4.4
20.7	4.3
21.6	4.1
21.9	4.1
22.9	3.9
23.2	3.8
24.4	3.6
25.0	3.6
25.5	3.5
26.0	3.4
27.4	3.3
28.8	3.1
29.2	3.1
30.7	2.9
31.1	2.9
32.7	2.7
36.3	2.5

Example 14 - Preparation and Characterization of Type L of Compound 1

Preparation of Type L of Compound 1

[0315] Type L was prepared by slow cooling, as described in Example 3.

Characterization of Type L of Compound 1

[0316] Type L was characterized by XRPD (Method C) analysis.

[0317] The XRPD pattern for Type L is depicted in Figure 28, and the corresponding data are summarized in the following table:

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
5.9	14.9
8.4	10.5

Pos. [$^{\circ}$ 2Th.]	d-spacing [$\text{\AA}$]
11.9	7.5
13.3	6.6
14.7	6.0
15.0	5.9
16.2	5.5
16.7	5.3
16.9	5.2
17.8	5.0
18.9	4.7
20.4	4.4
21.2	4.2
21.6	4.1
22.2	4.0
23.9	3.7
24.6	3.6
25.5	3.5
25.7	3.5
26.1	3.4
26.8	3.3
28.1	3.2
28.8	3.1
29.9	3.0
30.6	2.9
31.9	2.8
32.4	2.8
33.6	2.7
34.2	2.6
35.6	2.5
36.1	2.5
38.2	2.4

[0318] Single crystal X-ray analysis revealed that Type L is a THF/water co-solvate of Compound 1, with Compound 1, THF, and water present in a 1:1:1 ratio.

Example 15 - Preparation and Characterization of Type M of Compound 1

Preparation of Type M of Compound 1

[0319] Type M was prepared by liquid vapor diffusion, as described in Example 3.

Characterization of Type M of Compound 1

[0320] Type M was characterized by XRPD (Method C) analysis.

[0321] The XRPD pattern for Type M is depicted in Figure 29, and the corresponding data are summarized in the following table:

Pos. [°2Th.]	d-spacing [Å]
4.5	19.5
5.8	15.3
6.1	14.4
8.7	10.2
9.0	9.9
9.7	9.1
12.3	7.2
13.1	6.8
13.7	6.4
14.5	6.1
15.1	5.9
15.6	5.7
16.8	5.3
17.4	5.1
18.0	4.9
18.5	4.8
19.5	4.5
20.0	4.4
21.4	4.1
21.9	4.1
22.3	4.0
22.9	3.9
23.3	3.8
23.5	3.8
24.1	3.7
25.0	3.6
25.8	3.5
26.3	3.4
26.7	3.3
27.8	3.2
28.1	3.2
29.4	3.0
30.8	2.9
31.7	2.8
33.0	2.7
35.3	2.5

Pos. [°2Th.]	d-spacing [Å]
37.8	2.4
38.6	2.3

Example 16 - Preparation and Characterization of the Spray-Dried Dispersion of Compound 1

[0322] A Spray Dried Dispersion (SDD) of Compound 1 was prepared. The SDD was made up of Compound 1 and a polymer (Hydroxypropylmethyl Cellulose AS-MG) at a 1:3 weight ratio. Compound 1 and the polymer were dissolved in organic solvents (Dichloromethane and Methanol) and spray dried to obtain amorphous an amorphous drug substance. The SDD comprising Compound 1 and HPMC AS (1:3) is referred to herein as SDD 0.

[0323] A spray solution was prepared at 7.8% solids content (1:3 Compound 1:HPMC AS-MG) in 80:20 DCM:Methanol per Table 18. An API correction factor of 0.966 was used to prepare the spray solution. The spray solution was prepped by adding DCM and Methanol to a 36L stainless steel mixing vessel. HPMC AS-MG was added to the solvent system while mixing with a top down mixer at a medium vortex. Compound 1 was then added to the solution. The solution had a yellow/brown clear appearance, however white fiber particulates were seen in the solution.

Table 18

Component	Formulation %	Weight, g
Compound 1	2.00%	595.0
HPMC AS-MG	5.81%	1724.3
DCM	73.75%	21896.0
Methanol	18.44%	5474.0
Total	100.0%	29689.3

Correction Factor: 0.9660

[0324] A Mobile Minor spray-drying apparatus was setup per Table 19 and warmed up for approximately one hour prior to spraying. Wash solution (80:20 DCM:Methanol) was sprayed prior to the active solution to allow the nozzle to equilibrate. The Compound 1 active solution was sprayed per the settings in Table 19. The spray-dried dispersion was dried overnight (~20 hours) in a Shel Vacuum Oven at 50°C and -25 in Hg vacuum under a nitrogen purge at 15 scfh. The resulting spray-dried dispersion was confirmed to be dry by GC analysis. This run generated approximately 2.1 kg of spray-dried dispersion.

Table 19

Parameter	Set Point
Inline Filter	Swagelok 140 μ m Stainless Steel
Nozzle	0.3 mm, 60° Angle
Inlet Air Flow	80 kg/hr
Inlet Air Temperature	104°C
Pump Stroke Length	5.70 mm
Nozzle Pressure	600 psi
Feed Rate (g/min)	184 g/min
Outlet Temp (°C)	36
Set Condenser Air Temp (°C)	-10
Actual Condenser Air Temp (°C)	-3
Chiller Temp (°C)	-20
Feed Temp	Ambient

[0325] The SDD was characterized by XRPD (Method B) and DSC analysis (ambient to 200°C, 2°C/minute ramp), as shown in Figures 30 and 31, respectively. The SDD was determined to be homogenous and amorphous, as shown by the amorphous diffractogram, lack of a crystalline melt, and a single T_g at 100°C.

Example 17- Bioavailability of the Spray-Dried Dispersion (SDD) of Compound 1 in Rats and Mice

[0326] The systemic exposure of Compound 1 in rats and mice was evaluated by dosing a SDD made up of Compound 1 and HPMC AS-MG (1:3) (SDD 0, which can be prepared as described in Example 16) dispersed in an aqueous vehicle (0.5% Hydroxypropylmethyl Cellulose in water). The SDD formulation (“500 mpk SDD”) dosed at 500 mg/kg to rats showed an AUC_{last} that was 40X greater than the maximum exposure obtained with the standard formulation (“300 mpk Suspension” made up of Compound 1 (Type A) in 10% Propylene Glycol, 10% Cremophore, 80% Water), as shown in Table 20 and Figure 32. Additionally, the exposure of a 500 mpk Nano-Suspension made up of nanoparticles of Compound 1 (Type A) was evaluated, as shown in Figure 32. Robust exposure was observed with SDD formulation in mouse as well.

Table 20

Animal	t_{1/2} (h)	t_{max} (h)	C_{max} (ng/mL)	AUClast (h*ng/mL)
Rat	3.22	1.67	44400	180603
Mouse	2.54	0.5	75200	113369

Example 18- Bioavailability of the Spray-Dried Dispersion of Compound 1 in Monkeys

[0327] Several formulations of Compound 1, including an SDD made up of Compound 1 and HPMC AS-MG (1:3) (SDD 0, which can be prepared as described in Example 16), were evaluated in monkeys. The compositions of the tested formulations are listed in Table 21.

Table 21

Formulation	Dosage Form	Composition
Formulation #1 (with Bile Salt)	Capsule; Size 0 White Opaque Gelatin	Compound 1 (Type A), micronized 49.9% Avicel PH101 23.5% AcDiSol 5.0% SLS 10.1% Na Taurocholate 10.0% Mg Stearate 0.5% Silicon Dioxide 1.0%
Formulation #2 (Formulated Capsule)	Capsule; Size 0 White Opaque Gelatin	Compound 1 (Type A) micronized API 49.9% Avicel PH101 33.3% AcDiSol 5.0% SLS 10.3% Mg Stearate 0.5% SiO ₂ 1.0%
Formulation #3 (Micronized fill)	Capsule; Size 0 White Opaque Gelatin	Compound 1 (Type A) micronized API only
Formulation #4 (SDD)	Suspension	Compound 1 Spray Dried Dispersion 0.5% Hydroxypropylmethyl Cellulose in Water

[0328] The formulations were evaluated for pharmacokinetic parameters in monkeys and are shown in Figure 33. The profiles show that the SDD formulation (Formulation 4) provided a

significant enhancement in overall exposure compared to the encapsulated formulations (Formulations 1, 2, and 3). The bioavailability enhancement with the SDD formulation is approximately 50-62%, which is several fold higher compared to the other formulations, at a dose equivalent to 100 mg.

Example 19- Time-dependent Solubility of Type A of Compound 1 and the Spray-dried Dispersion of Compound 1 in Biorelevant Media

[0329] The solubility of Type A of Compound 1 was evaluated in aqueous media. Aqueous solubility samples of Type A of Compound 1 were saturated with solid content. Samples were shaken at 37°C for 24 hours. Each aqueous media was also sampled after 30 minutes and filtered/diluted using the same procedure to be used for the t = 24-hour samples. Sample pH was only measured after 24-hour equilibration.

[0330] Following 24-hour equilibration, the pH of the saturated samples was measured, and the mixtures were centrifuged through 0.22 µm nylon filters at 15,000 rpm for approximately 2 minutes. All centrifuged samples were diluted with method diluent and analyzed by HPLC (Method A). If no solids were present after overnight equilibration, the solubility was reported as “≥” to the determined value. The concentrations reported are based on a single point calibration at the method nominal and are reported as the free form. Results are shown in Table 22 and Figure 34.

Table 22

Sample	t= 30 minutes Solubility (µg/mL)	t= 24 hours Solubility (µg/mL)	Measured pH (after 24-hours)
Water	36.29	24.98	8.69
50mM Phosphate pH 2.0	35.31	24.16	1.98
50mM Citrate pH 5.0	32.53	23.49	5.01
50mM Phosphate pH 7.4	33.43	22.72	7.36
Simulated Gastric Fluid (SGF)	39.65	26.60	1.07
Fasted-State Simulated Intestinal Fluid (FaSSIF)	45.84	30.48	6.52
Fed-State Simulated Intestinal Fluid (FeSSIF)	67.04	48.18	5.01

[0331] Solubility of the 1:3 Compound 1: HPMC-AS-MG spray-dried dispersion (SDD 0, which can be prepared as described in Example 16) was assessed in aqueous media at various timepoints over 24-hours. Individual saturated samples were prepared for each anticipated time

point by adding ~10mg of SDD material to 1.5mL of solvent. Samples were placed at 37°C on a thermal shaker at 600RPM and pulled at t= 2min, 5min, 15min, 30min, 1hr, 2hr, 4hr, 6hr, and 24-hours. The mixtures were centrifuged through 0.22 μ m nylon filters at 15,000 rpm for approximately 5 minutes. All centrifuged samples were diluted with method diluent and analyzed by HPLC (Method A). Sample pH was measured only at 24-hours. Results are shown in Table 23 and Figure 35.

Table 23

Media	Solubility (μ g/mL) at Actual Time (min)									Final pH
	2	8	15	29	59	120	240	360	1435	
50mM Phosphate pH 2	169.5	207.2	238.7	258.9	288.4	278.0	258.5	276.0	65.0	1.91
50mM Citrate pH 5	163.5	213.2	239.1	260.5	281.7	244.9	245.7	248.1	149.1	4.96
50mM Phosphate pH 7.4	148.4	138.6	86.1	83.1	117.3	38.1	22.8	25.6	15.5	7.19
Water	203.7	132.4	80.4	65.7	64.0	58.8	64.3	50.9	48.9	5.11
SGF	199.8	225.7	272.8	289.9	299.6	276.8	273.5	256.7	125.1	1.05
FaSSIF	175.5	160.0	120.5	128.5	164.1	5005.9 ¹	72.4	67.7	46.4	5.65
FeSSIF	413.1	453.5	490.1	536.0	532.9	536.0	558.5	522.2	76.2	5.02

¹Solids observed in centrifuge filter, resuspended in case of supersaturation, however high value suggests faulty filter. Time point omitted from the solubility profile in Figure 35.

[0332] The solubility of the SDD was significant, particularly at earlier time points. Solubility of the SDD after four hours was 72.4 μ g/mL in FaSSIF and 558.5 μ g/mL in FeSSIF. Four-hour solubility of the SDD is 273.5 μ g/mL in SGF. The solubility decreased after 24-hour equilibration in all aqueous media tested.

Example 20 - Stability Assessment of the Spray-Dried Dispersion of Compound 1

[0001] Stability studies were conducted on two distinct lots of the 1:3 Compound 1: HPMC-AS-MG spray-dried dispersion (SDD 0, which can be prepared as described in Example 16) under the conditions outlined in Table 24. The results of the stability study for each lot and storage condition are reported in the Tables identified in Table 24. The results for Lot 1 at the 5 month time point and Lot 2 at the 1 month time point remained consistent with the T=0 time points.

Table 24

Lot No.	Container	Storage Condition	Table
Lot 1	Double-bagged LDPE bags, Zip-tied, inside a sealed Mylar pouch with a 1g desiccant packet	2-8°C/ Ambient RH 25±2°C/60±5%RH	Table 25 Table 26
Lot 2	Double-bagged LDPE bags, Zip-tied, inside a sealed Mylar pouch with a 1g desiccant packet	2-8°C/ Ambient RH 25±2°C/60±5%RH 40±2°C/75±5%RH	Table 27 Table 28 Table 29

Table 25

Storage Conditions: 2-8°C/Ambient RH	Lot 1	
Test Method	Time Point (months)	
	0	5
Water Content	2.12%	1.07%
DSC (Method B)	T _G at 97.707 °C, absence of melt	T _G at 97.555 °C, absence of melt
XRPD (Method D)	No measurable crystalline material observed	No measurable crystalline material

Table 26

Storage Conditions: 25±2°C/60±5%RH	Lot 1	
Test Method	Time Point (months)	
	0	5
Water Content	2.12%	1.03%
DSC (Method B)	T _G at 97.707°C, absence of melt	T _G at 98.630°C, absence of melt
XRPD (Method D)	No measurable crystalline material observed	No measurable crystalline material observed

Table 27

Storage Conditions: 2-8°C/Ambient RH		Lot 2	
Test Method	Time Point (months)		
	0	1	
Water Content	1.24%	0.95%	
DSC (Method B)	T _G at 100.345 °C, absence of melt	T _G at 99.456 °C, absence of melt	
XRPD (Method D)	XRPD Diffractogram showed amorphous halo without any distinct peaks	XRPD Diffractogram showed amorphous halo without any distinct peaks	

Table 28

Storage Conditions: 25±2°C/60±5%RH		Lot 2	
Test Method	Time Point (months)		
	0	1	
Water Content	1.24%	0.77%	
DSC (Method B)	T _G at 100.345 °C, absence of melt	T _G at 99.343 °C, absence of melt	
XRPD (Method D)	XRPD Diffractogram showed amorphous halo without any distinct peaks	XRPD Diffractogram showed amorphous halo without any distinct peaks	

Table 29

Storage Conditions: 40±2°C/75±5%RH		Lot 2	
Test Method	Time Point (months)		
	0	1	
Water Content	1.24%	0.74%	
DSC (Method B)	T _G at 100.345 °C, absence of melt	T _G at 98.367 °C, absence of melt	
XRPD (Method D)	XRPD Diffractogram showed amorphous halo without any distinct peaks	XRPD Diffractogram showed amorphous halo without any distinct peaks	

Example 21 - Preparation and Characterization of Spray-Dried Dispersions of Compound 1

[0333] Spray solutions having varying ratios of Compound 1 to polymer (Hydroxypropylmethyl Cellulose AS-MG) were prepared at 8% solids content in 80:20 DCM:MeOH (Table 30). The spray solutions were spray dried using a Procept 4M8-Trix unit with the settings detailed in Table 31. The resulting spray dried dispersions (SDDs) were dried at 50 °C at -25 in. Hg in a nitrogen purged vacuum oven for 19 hours. The SDDs were evaluated by XRPD analysis (Method D; Figure 36) and DSC analysis (Method B; Figure 37). The SDDs appeared amorphous by PXRD analysis, with no crystalline diffraction peaks observed. A single well defined T_G was seen by DSC for all dispersions. No melt endotherm was observed, further verifying the amorphous nature of all spray dried dispersions. Residual solvent analysis of the spray dried dispersions dried for 19 hours showed varying levels for dichloromethane. An observed trend is that levels of dichloromethane increase with increased ratios of Compound 1 to Polymer.

Table 30

Sample	Weight Ratio (Compound 1 : Polymer)	% Compound 1	% Polymer
SDD 1	2:3	40%	60%
SDD 2	1:1	50%	50%
SDD 3	2:1	66.7%	33.3%
SDD 4	3:1	75%	25%

Table 31

Parameter	Setting
Nozzle Orifice	1.0 mm
Inlet Air Speed	0.35 – 0.39 m ³ /min
Inlet Temp	50°C - 60°C
Flow Rate	~10 g/min
Pump Speed	70-80%
Atom. Gas Flow	15 L/min
Outlet Temp	36°C

Example 22 - Preparation and Characterization of Spray-Dried Dispersions of Compound 1

[0334] Spray solutions having varying ratios of Compound 1 to polymer (Hydroxypropylmethyl Cellulose AS-MG) were prepared at 12% solids content in 80:20

DCM:MeOH (Table 32). The spray solutions were sprayed on a GEA Mobile Minor spray dryer, and the SDDs were collected and dried at 50 °C and -25 in Hg under a N₂ purge.

Table 32

Sample	Weight Ratio (Compound 1 : Polymer)
SDD 5	1:1
SDD 6	1.5:1

Example 23 - Kinetic Solubility of Compound 1 SDDs

[0335] A μ DISS Profiler™ instrument from Pion, Inc was used to quantify concentrations during equilibrium solubility experiments involving SDD 0 (which can be prepared as described in Example 16) and SDDs 1-4 (which can be prepared as described in Example 21). The unit consists of six photodiode array (PDA) spectrophotometers, each with its own dedicated fiber optic dip probe, center-positioned in the glass vial holding 10 mL of media. The concentration measurements are performed directly in the assay media, with processed results plotted in “real time.”

[0336] Probes with 2-mm path length tips were selected for quantification of Compound 1 in SDD. The developed calibration curves were used for quantification of Compound 1 in the samples during kinetic solubility experiments at each time point. The 2-mm path length tips were selected for detecting concentrations of Compound 1 in both SGF and FaSSIF media.

[0337] Standard calibration curves were generated in the respective assay media using a serial addition protocol. A stock solution of Compound 1 was prepared in DMSO at ~20 mg/mL. Calculated aliquots of the stock were added to the respective buffers in order to prepare several standard solutions spanning specific concentration ranges. Concentrations of the standard solutions ranged from ~50 to ~300 μ g/mL for channels in both SGF and FaSSIF media respectively. The area under the 2nd derivative curves was used to calculate the concentrations. The wavelength range was selected for the compounds in such a way that sensitivity issues were avoided. Linearity of the standard curves in the selected wavelength regions were characterized by $r^2 \geq 0.999$.

[0338] Area under the 2nd derivative curve in 285-300 nm (SGF) and 305-320 nm (FaSSIF) range were used to calculate the standard curves in respective media. The corresponding standard curves were used to determine concentrations of Compound 1 in solubility assays.

[0339] Required amount of SDD materials, equivalent to 20 mg of Compound 1 were weighed into 20mL glass vials. The vials were then transferred to the instrument for analysis. A clean stir bar was added to the vial with sample. 16mL of SGF buffer was transferred to the vials before beginning the experiment to achieve an upper limit of ~1.25mg/mL. The stirring was maintained at 220 RPM and the temperature of the medium at 37°C. Kinetic solubility data was collected for 30 minutes in SGF media. The data showed that all the SDD's at different loadings exhibited very similar release profile and achieved about same concentration of Compound 1 (~300µg/mL).

[0340] At the 30-minute interval, the media was converted to FaSSIF 6.5. The final volume in the vials was increased to 20mL from 16mL (1.00mg/mL). The resulting samples were then analyzed using the µDiss Profiler for ~18H in FaSSIF.

[0341] The SDD 0 formulation with 25% drug loading reached higher solubility of ~700µg/mL but did not remain in the supersaturated state for longer time. Although the solubility of SDD 0 at 4H was slightly lower than the 40% API loading SDD 1, the equilibrium solubility after ~16 hours was higher than all other SDD systems. SDD 3 and SDD 4 did not reach as high of a concentration (spring effect) as SDD 0. However, SDD 3 and SDD 4 both stayed at supersaturated state for longer time when compared to all other SDD systems tested. However, the equilibrium solubility for SDD 3 and SDD 4 after 16 hours was lower than SDD 0. SDD 2 and SDD 3 show marked enhancement in the solubility and prolonged supersaturation. The Kinetic solubility profiles are shown in Figure 38.

[0342] The results are summarized in Table 33. All the solubility Results reported in the table are an average of n=2 replicates.

Table 33

Parameter	SDD 0 (1:3)	SDD 1 (2:3)	SDD 2 (1:1)	SDD 3 (2:1)	SDD 4 (3:1)
30 min SGF (µg/mL)	293.34	338.27	371.81	340.56	374.24
Cmax (µg/mL)	708.65	658.09	618.76	603.12	609.61
4H (µg/mL)	438.55	450.60	476.06	603.03	307.06
Eq Sol (16H) (µg/mL)	301.75	250.53	221.95	243.60	226.20

Example 24 - Stability of Spray Dried Dispersions of Compound 1

[0343] Spray dried dispersions of Compound 1 (SDD 0 (which can be prepared as described in Example 16) and SDDs 1-4 (which can be prepared as described in Example 21)) were set up on a short-term stability study in two different storage configurations at various storage conditions. Samples were set up as “Sealed” and “Exposed”. Sealed samples were placed into crimp sealed vials and stored in a single storage condition; 60°C. The exposed samples were placed into a vial that was covered lightly with perforated foil to allow exposure to the humidity conditions. The exposed samples were stored at 40°C/75%RH and 60°C/75%RH. Samples were pulled after T = 1 and 2 weeks for PXRD analysis (Method D).

[0344] PXRD diffractograms taken after 2 weeks for SDDs 0-4 are provided in Figures 39-43, respectively, and the results are summarized in Table 34. SDDs 0, 1, 2 and 3 showed amorphous character by PXRD at all tested conditions through 2 weeks. SDD 4 showed crystallinity by PXRD after 2 weeks of storage at 60 °C/75% RH (exposed). SDD 4 also showed two glass transition temperatures by DSC (Method B) after 2 weeks of storage at 60 °C/75% RH (exposed), suggesting phase separation.

Table 34

SDD	Storage Condition	Time Point (weeks)	
		1	2
SDD 0 (1:3)	60 °C Sealed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	40 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	60 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
SDD 1 (2:3)	60 °C Sealed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	40 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	60 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD

SDD	Storage Condition	Time Point (weeks)	
		1	2
SDD 2 (1:1)	60 °C Sealed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	40 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	60 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
SDD 3 (2:1)	60 °C Sealed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	40 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	60 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
SDD 4 (3:1)	60 °C Sealed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	40 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	No crystalline diffraction peaks observed by PXRD
	60 °C/75% RH Exposed	No crystalline diffraction peaks observed by PXRD	Crystalline diffraction peaks observed by PXRD

Example 25 - Stability of Spray Dried Dispersions of Compound 1

[0345] Spray dried dispersions of Compound 1 (SDDs 5 and 6 (Example 22)) were stored in two different storage configurations at various storage conditions. Samples were set up as “Sealed” and “Exposed”. Sealed samples were stored in an amber crimp sealed vial at the following conditions: 2-8°C, 25°C/60%RH, 40°C/75%RH, and 60°C. Exposed samples were stored in an amber crimp vial covered with foil, which was perforated to allow exposure to humidity, at the following conditions: 25°C/75%RH, 40°C/75% RH, and 60°C/75% RH.

[0346] Samples were analyzed by PXRD (Method D) and/or DSC (Method B) analysis at T = 0, 1, and 2 weeks. Results are summarized in Table 35. No crystalline diffraction peaks were

observed by PXRD in any sample. Moreover, a single T_g and no melt endotherm was seen by DSC in all samples.

Table 35

SDD	Storage Condition	Time Point (weeks)		
		0	1	2
SDD 5 (1:1)	N/A (T = 0 time point)	No crystalline diffraction peaks observed by PXRD (Figure 44); A single T_g and no melt endotherm was seen by DSC (Figure 45)	N/A	N/A
	60 °C Sealed	N/A	No crystalline diffraction peaks observed by PXRD (Figure 46); A single T_g and no melt endotherm was seen by DSC (Figure 47)	A single T_g and no melt endotherm was seen by DSC (Figure 48)
	25 °C/60% RH Exposed	N/A	No crystalline diffraction peaks observed by PXRD (Figure 46); A single T_g and no melt endotherm was seen by DSC (Figure 47)	A single T_g and no melt endotherm was seen by DSC (Figure 48)
	40 °C/75% RH Exposed	N/A	No crystalline diffraction peaks observed by PXRD (Figure 46); A single T_g and no melt endotherm was seen by DSC (Figure 47)	A single T_g and no melt endotherm was seen by DSC (Figure 48)

SDD	Storage Condition	Time Point (weeks)		
		0	1	2
SDD 6 (1.5:1)	N/A (T = 0 time point)	No crystalline diffraction peaks observed by PXRD (Figure 44); A single T _G and no melt endotherm was seen by DSC (Figure 45)	N/A	N/A
	60 °C Sealed	N/A	No crystalline diffraction peaks observed by PXRD (Figure 49); A single T _G and no melt endotherm was seen by DSC (Figure 50)	A single T _G and no melt endotherm was seen by DSC (Figure 51)
	25 °C/60% RH Exposed	N/A	No crystalline diffraction peaks observed by PXRD (Figure 49); A single T _G and no melt endotherm was seen by DSC (Figure 50)	A single T _G and no melt endotherm was seen by DSC (Figure 51)
	40 °C/75% RH Exposed	N/A	No crystalline diffraction peaks observed by PXRD (Figure 49); A single T _G and no melt endotherm was seen by DSC (Figure 50)	A single T _G and no melt endotherm was seen by DSC (Figure 51)

[0347] Kinetic dissolution of SDD 5 and SDD 6 samples was determined at T = 0 and T = 1 week (40 °C/75% RH Exposed; and 40 °C/75% RH Sealed) using the procedure described in Example 23. The results are summarized in Table 36.

Table 36

Parameter	T = 0		T = 1 wk (40 °C/75% RH Exposed)		T = 1 wk (40 °C/75% RH Sealed)	
	SDD 5 (1:1)	SDD 6 (1.5:1)	SDD 5 (1:1)	SDD 6 (1.5:1)	SDD 5 (1:1)	SDD 6 (1.5:1)
30 min SGF (µg/mL)	611.68	622.80	600.49	628.89	623.46	616.29
C _{max} (µg/mL)	245.38	261.77	240.34	291.21	272.17	269.01
4H (µg/mL)	127.07	130.55	291.28	256.72	171.49	189.91
Eq Sol (µg/mL)	93.37	92.71	153.88	162.06	139.64	150.04

Example 26 - Composition and Preparation of a Tablet Dosage Form of Compound 1

Composition of the Tablet Dosage Form

[0348] A tablet dosage form of Compound 1 comprising an SDD made up of Compound 1 and HPMC AS-MG (1:3) compressed into tablets and film coated with compendial excipients was prepared. The tablets were presented as 25 mg (white coated round shaped tablets) and 100 mg (white coated oval shaped tablets) dose strengths. The composition of each dosage strength is summarized in Table 37.

Table 37

Component		% Formulation	Function
Intra Granular Components	Compound 1 Spray Dried Dispersion ¹	50.00%	Drug Product Intermediate
	Microcrystalline Cellulose	30.00%	Filler
	Crospovidone	5.00%	Dry binder
	Colloidal Silicon Dioxide	1.00%	Glidant
	Magnesium Stearate	0.25%	Lubricant

Component		% Formulation	Function
Extra Granular Components	Microcrystalline Cellulose	11.00%	Filler
	Croscarmellose Sodium	2.50%	Disintegrant
	Magnesium Stearate	0.25%	Lubricant
	Total Common Formulation Blend per Tablet	100%	----
Coating Components	Sterile Water for Injection (SWFI)	Removed through processing	Processing aid
	Opadry amb II White	6.00	Film Coating Agent
	Total weight of coated tablet		

1= Quantity based upon a 25.00% (w/w) potency of Compound 1 drug substance in the spray dried intermediate.

Preparation of the Tablet Dosage Form

[0349] The Compound 1 tablet formulation manufacturing process consists of four steps: 1) spray dry dispersion, 2) intragranular granulation, roller compaction/milling/blending, 3) extragranular granulation/blending, and 4) tableting and coating. The initial step of spray dry dispersion is performed by creating an organic solution containing Compound 1 drug substance, and Hypromellose Acetate Succinate (Hydroxypropyl Methylcellulose Acetate Succinate MG) (HPMCAS-MG). The solution is spray dried to produce an SDD made up of Compound 1 and HPMC AS-MG (1:3), using a method analogous to the method of Example 16. The SDD is blended with intra granular excipients followed by roller compaction/milling and blending. The resulting granulation is then mixed with the extra-granular components to create the final common granulation blend. The final blend is pressed into tablets equivalent to either 25 mg or 100 mg active followed by coating.

Example 27 - Dissolution Assessment of the Tablet Dosage Form

[0002] The 100 mg tablets described in Example 26 were tested for dissolution. Dissolution testing parameters are provided in Table 38, and results are summarized in Table 39.

Table 38

Parameter	Condition
Apparatus	USP Apparatus 2 (Paddles)
Media	SIF without enzyme
Vessel Size and Type	1000 mL Amber
Media Volume	900 mL
Temperature	37.0 ± 0.5°C
Speed	0-60 min: 50 ± 2 RPM, 60 – 75 min: 200 ± 8 RPM
Time Points	15, 30, 45, and 60 minutes
Filters	13 mm, 0.2 µm Nylon
Theoretical Concentration	111.1111 µg/mL
Sampling Procedure	Remove 3 mL of sample and filter through a 13 mm, 0.2 µm Nylon filter, discarding the first 2 mL to waste and collecting the remaining 1 mL in an amber UPLC vial for analysis.

Table 39

Time Point	Min % Diss.	Max % Diss.	Mean % Diss.
15 min	58.4	89.6	79.1
30 min	88.0	92.9	91.2
45 min	90.7	93.9	92.7
60 min	90.9	94.2	93.0

Example 28 - Release Testing of the Tablet Dosage Form

[0350] Dissolution testing of 25 mg and 100 mg tablets having the composition specified in Example 26 was performed following the dissolution parameters listed in Table 40. Dissolution was determined by UPLC analysis. The results of the dissolution testing are reported in Table 41 and Figure 52.

Table 40

Parameter	Condition
Apparatus	USP Apparatus 2 (Paddles)
Media	SIF without enzyme
Vessel Size and Type	1000 mL Amber
Media Volume	100 mg: 900 mL 25 mg: 500 mL
Temperature	37.0 ± 0.5°C
Speed	75 ± 3 RPM

Parameter	Condition
Time Points	15, 30, 45, and 60 minutes
Filters	13 mm, 0.2 μ m Nylon
Theoretical Concentration	100 mg: 111.1111 μ g/mL 25 mg: 50.0000 μ g/mL
Sampling Procedure	Remove 3 mL of sample and filter through a 13 mm, 0.2 μ m Nylon filter, discarding the first 2 mL to waste and collecting the remaining 1 mL in an amber UPLC vial for analysis.

Table 41

Time	100 mg Tablet	25 mg Tablet
15 min	Min: 93.7	Min: 89.6
	Max: 98.3	Max: 99.8
	Mean: 95.8	Mean: 95.7
30 min	Min: 97.2	Min: 91.6
	Max: 98.6	Max: 100.4
	Mean: 98.1	Mean: 96.8
45 min	Min: 97.4	Min: 93.1
	Max: 98.8	Max: 100.6
	Mean: 98.2	Mean: 97.4
60 min	Min: 97.4	Min: 94.4
	Max: 98.9	Max: 101.1
	Mean: 98.2	Mean: 98.3

Example 29- Stability Assessment of the Tablet Dosage Form

[0351] Stability studies were conducted under the conditions outlined in Table 42 on two distinct lots of 25 mg and 100 mg tablets having the composition specified in Example 26. The results of the stability study for each lot and storage condition are reported in the Tables identified in Table 42.

[0352] The tablets were prepared for XRPD analysis (Method D) by crushing a tablet with a mortar and pestle and transferring 5-10 mg of material to a sample pan, slightly overfilling and

ensuring that powder is spread evenly to cover the bottom of the plate. Weigh paper was placed atop the powder and pressed down gently to even the powder surface. The XRPD pattern of the tablet was overlaid with the XRPD pattern of a reference standard (Compound 1, Type A). A tablet was deemed to be free of the diffraction peaks that are present in the reference standard only if the peak at ~15 degrees 2-theta is absent. A small, irregular peak at ~3 degrees 2-theta is acceptable.

Table 42

Dosage & Lot No.	Container	Storage Condition	Results Table
25 mg Lot 1	30cc wide mouth round white HDPE bottle, capped with 28 mm child resistant closure and induction sealed	25 ± 2 °C/ 60 ± 5 %RH	Table 43
		40 ± 2 °C/ 75 ± 5%RH	Table 44
100 mg Lot 1	60cc wide mouth round white HDPE bottle, capped with 33 mm child resistant closure and induction sealed	25 ± 2 °C/ 60 ± 5 %RH	Table 45
		40 ± 2 °C/ 75 ± 5%RH	Table 46
25 mg Lot 2	30cc wide mouth round white HDPE bottle, capped with 28 mm child resistant closure and induction sealed	25 ± 2 °C/ 60 ± 5 %RH	Table 47
		40 ± 2 °C/ 75 ± 5%RH	Table 48
100 mg Lot 2	60cc wide mouth round white HDPE bottle, capped with 33 mm child resistant closure and induction sealed	25 ± 2 °C/ 60 ± 5 %RH	Table 49
		40 ± 2 °C/ 75 ± 5%RH	Table 450

Table 43

Lot 1 Tablets, 25 mg					
Storage Conditions: 25±2°C/60±5%RH					
		Time Point (months)			
Test Method		0	1	2	3
Dissolution	15 min	Min: 90% Max: 100% Mean: 96%	Min: 90% Max: 98% Mean: 94%	Min: 85% Max: 98% Mean: 93%	Min: 78% Max: 86% Mean: 81%
	30 min	Min: 92% Max: 100% Mean: 97%	Min: 92% Max: 99% Mean: 96%	Min: 87% Max: 99% Mean: 94%	Min: 81% Max: 89% Mean: 84%
	45 min	Min: 93% Max: 101% Mean: 97%	Min: 93% Max: 99% Mean: 97%	Min: 88% Max: 100% Mean: 95%	Min: 82% Max: 89% Mean: 85%
	60 min	Min: 94% Max: 101% Mean: 98%	Min: 94% Max: 100% Mean: 98%	Min: 90% Max: 100% Mean: 95%	Min: 84% Max: 91% Mean: 87%
Water Content		3.52%	2.90%	1.92%	1.79%
XPRD (Method D)		No crystalline peaks present	No crystalline peaks present	No crystalline peaks present	No crystalline peaks present

Table 44

Lot 1 Tablets, 25 mg					
Storage Conditions: 40±2°C/75±5%RH					
		Time Point (months)			
Test Method		0	1	2	3
Dissolution	15 min	Min: 90% Max: 100% Mean: 96%	Min: 81% Max: 92% Mean: 87%	Min: 78% Max: 97% Mean: 89%	Min: 74% Max: 85% Mean: 80%
	30 min	Min: 92% Max: 100% Mean: 97%	Min: 83% Max: 99% Mean: 91%	Min: 81% Max: 97% Mean: 91%	Min: 78% Max: 91% Mean: 85%
	45 min	Min: 93% Max: 101% Mean: 97%	Min: 85% Max: 100% Mean: 92%	Min: 83% Max: 98% Mean: 92%	Min: 80% Max: 92% Mean: 86%
	60 min	Min: 94% Max: 101% Mean: 98%	Min: 85% Max: 100% Mean: 92%	Min: 84% Max: 98% Mean: 93%	Min: 81% Max: 93% Mean: 88%
Water Content		3.52%	2.66%	1.71%	1.95%
XPRD (Method D)		No crystalline peaks present	No crystalline peaks present	No crystalline peaks present	No crystalline peaks present

Table 45

Lot 1 Tablets, 100 mg					
Storage Conditions: 25±2°C/60±5%RH					
		Time Point (months)			
Test Method		0	1	2	3
Dissolution	15 min	Min: 94% Max: 98% Mean: 96%	Min: 85% Max: 87% Mean: 86%	Min: 100% Max: 100% Mean: 100%	Min: 96% Max: 98% Mean: 97%
	30 min	Min: 97% Max: 99% Mean: 98%	Min: 89% Max: 90% Mean: 90%	Min: 100% Max: 100% Mean: 100%	Min: 97% Max: 99% Mean: 98%
	45 min	Min: 97% Max: 99% Mean: 98%	Min: 91% Max: 92% Mean: 91%	Min: 100% Max: 101% Mean: 100%	Min: 98% Max: 99% Mean: 99%
	60 min	Min: 97% Max: 99% Mean: 98%	Min: 92% Max: 92% Mean: 92%	Min: 100% Max: 101% Mean: 100%	Min: 98% Max: 99% Mean: 99%
Water Content		3.83%	2.57%	2.39%	2.72%
XPRD (Method D)		No crystalline peaks present	No crystalline peaks present	No crystalline peaks present	No crystalline peaks present

Table 46

Lot 1 Tablets, 100 mg					
Storage Conditions: 40±2°C/75±5%RH					
		Time Point (months)			
Test Method		0	1	2	3
Dissolution	15 min	Min: 94% Max: 98% Mean: 96%	Min: 86% Max: 94% Mean: 89%	Min: 99% Max: 99% Mean: 99%	Min: 94% Max: 95% Mean: 95%
	30 min	Min: 97% Max: 99% Mean: 98%	Min: 90% Max: 95% Mean: 93%	Min: 99% Max: 99% Mean: 99%	Min: 95% Max: 96% Mean: 95%
	45 min	Min: 97% Max: 99% Mean: 98%	Min: 92% Max: 95% Mean: 94%	Min: 99% Max: 99% Mean: 99%	Min: 95% Max: 96% Mean: 96%
	60 min	Min: 97% Max: 99% Mean: 98%	Min: 93% Max: 96% Mean: 95%	Min: 99% Max: 99% Mean: 99%	Min: 95% Max: 96% Mean: 96%
Water Content		3.83%	2.90%	2.73%	4.09%
XPRD (Method D)		No crystalline peaks present	No crystalline peaks present	No crystalline peaks present	No crystalline peaks present

Table 47

Lot 2 Tablets, 25 mg			
Storage Conditions: 25±2°C/60±5%RH			
		Time Point (months)	
Test Method		0	1
Dissolution	15 min	Min: 92% Max: 98% Mean: 95%	Min: 81% Max: 96% Mean: 91%
	30 min	Min: 92% Max: 99% Mean: 96%	Min: 83% Max: 98% Mean: 93%
	45 min	Min: 94% Max: 99% Mean: 97%	Min: 85% Max: 99% Mean: 94%
	60 min	Min: 94% Max: 100% Mean: 98%	Min: 87% Max: 100% Mean: 96%
Water Content		2.18%	1.62%
XRPD (Method D)		Free of the diffraction peaks that are present in the reference standard	NT

Table 48

Lot 2 Tablets, 25 mg			
Storage Conditions: 40±2°C/75±5%RH			
		Time Point (months)	
Test Method		0	1
Dissolution	15 min	Min: 92% Max: 98% Mean: 95%	Min: 88% Max: 98% Mean: 95%
	30 min	Min: 92% Max: 99% Mean: 96%	Min: 94% Max: 100% Mean: 97%
	45 min	Min: 94% Max: 99% Mean: 97%	Min: 97% Max: 101% Mean: 99%
	60 min	Min: 94% Max: 100% Mean: 98%	Min: 98% Max: 101% Mean: 100%
Water Content		2.18%	1.65%
XRPD (Method D)		Free of the diffraction peaks that are present in the reference standard	NT

Table 49

Lot 2 Tablets, 100 mg			
Storage Conditions: 25±2°C/60±5%RH			
		Time Point (months)	
Test Method		0	1
Dissolution	15 min	Min: 99% Max: 101% Mean: 100%	Min: 96% Max: 98% Mean: 97%
	30 min	Min: 98% Max: 100% Mean: 99%	Min: 98% Max: 100% Mean: 99%
	45 min	Min: 99% Max: 101% Mean: 100%	Min: 98% Max: 100% Mean: 99%
	60 min	Min: 100% Max: 101% Mean: 100%	Min: 98% Max: 99% Mean: 98%
Water Content		2.74%	2.94%

Lot 2 Tablets, 100 mg			
Storage Conditions: 25±2°C/60±5%RH			
Test Method		Time Point (months)	
		0	1
XRPD (Method D)		Free of the diffraction peaks that are present in the reference standard	NT

Table 50

Lot 2 Tablets, 100 mg			
Storage Conditions: 40±2°C/75±5%RH			
Test Method		Time Point (months)	
		0	1
Dissolution	15 min	Min: 99% Max: 101% Mean: 100%	Min: 96% Max: 98% Mean: 97%
	30 min	Min: 98% Max: 100% Mean: 99%	Min: 98% Max: 99% Mean: 98%
	45 min	Min: 99% Max: 101% Mean: 100%	Min: 99% Max: 100% Mean: 99%
	60 min	Min: 100% Max: 101% Mean: 100%	Min: 99% Max: 100% Mean: 99%
Water Content		2.74%	3.04%
XRPD (Method D)		Free of the diffraction peaks that are present in the reference standard	NT

[0353] The results for the tablet batches from Lot 1 at the 3 month time point and Lot 2 at the 1 month time point remained consistent with the T=0 time points.

Example 30 - Composition and Preparation of a Tablet Dosage Form of Compound 1

[0354] Tablets comprising a spray dried dispersion (SDD) of Compound 1 and compendial excipients are prepared at 100 mg and 200 mg dosage strengths. The compositions of the tablets are set forth in Tables 51 and 52.

[0355] The tablets are prepared by first manufacturing the SDD (spray drying an organic solution of Compound 1 and HPMC-AS (1:1 w/w) (Table 51) or an organic solution of Compound 1 and HPMC-AS (1.5:1 w/w) (Table 52)), followed by roller compaction/milling with intragranular excipients and blending with extragranular excipients. The final blend is pressed into tablets and then film coated.

Table 51

Component	Function	Range
SDD (1:1)	Active	50-75%
Microcrystalline Cellulose	Filler	15-30%
Lactose Monohydrate	Filler	0-20%
Crosslinked polyvinylpyrrolidone	Dry Binder	2-10%
Colloidal Silicon Dioxide	Glidant	<2%
Croscarmellose Sodium	Disintegrant	2-10%
Magnesium Stearate	Lubricant	<2%

Table 52

Component	Function	Range
SDD (1.5:1)	Active	50-75%
Microcrystalline Cellulose	Filler	15-30%
Lactose Monohydrate	Filler	0-20%
Crosslinked polyvinylpyrrolidone	Dry Binder	2-10%
Colloidal Silicon Dioxide	Glidant	<2%
Croscarmellose Sodium	Disintegrant	2-10%
Magnesium Stearate	Lubricant	<2%

Example 31 - Stability Assessment of the Tablet Dosage Form

[0356] Tablets having the compositions set forth in Tables 51 and 52 were prepared for XRPD analysis (Method D) by crushing a tablet with a mortar and pestle and transferring 5-10 mg of material to a sample pan, slightly overfilling and ensuring that powder is spread evenly to cover the bottom of the plate. Weigh paper was placed atop the powder and pressed down gently to even

the powder surface. The XRPD pattern of the tablet was overlaid with the XRPD pattern of a reference standard (Compound 1, Type A). The XRPD pattern of a tablet was deemed to be free of the diffraction peaks that are present in the reference standard only if the peak at ~15 degrees 2-theta is absent. A small, irregular peak at ~3 degrees 2-theta is acceptable. The tablets were determined to be free of crystalline Type A because the XRPD patterns were free of the diffraction peaks that are present in the reference standard.

Example 32 – Determination of Maximum Dose of Compound 2

[0357] Good Laboratory Practice (GLP) toxicology testing of a Compound 1 test article comprising a pre-determined amount of Compound 2 was performed in rat and cynomolgus monkeys. A no-observed-adverse-effect level (NOAEL) was determined for each species using standard toxicology techniques, and a resulting dose level for humans was calculated using the FDA Human Equivalent Dose approach based upon dose per body surface area. Based on these experiments and calculations, a maximum recommended starting dose (MRSD) for first-in-human clinical trials was determined based on results from GLP toxicology testing. API compositions of Compound 1 containing less than 5.0% (as determined by percentage area HPLC) of Compound 2 are well within the safe human equivalent dose determined for Compound 2.

CLAIMS

What is claimed is:

1. A solid oral dosage form comprising a stabilized amorphous compound (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one, wherein the stabilized amorphous compound does not show crystallinity by PXRD (Method D) after 2 weeks of storage at 60 °C/75% RH (exposed).
2. The solid oral dosage form of claim 1, wherein the stabilized amorphous compound shows a single glass transition temperature (T_g) and no melt endotherm by DSC (Method B) after 2 weeks of storage at 60 °C/75% RH (exposed).
3. The solid oral dosage form of any one of claims 1 or 2, wherein the solid oral dosage form contains a total of 200 mg of (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one.
4. The solid oral dosage form of any one of claims 1-3, wherein the solid oral dosage form has a total weight of not more than 800 mg.
5. The solid oral dosage form of claim 4, wherein the solid oral dosage form is a tablet or capsule.
6. The solid oral dosage form of claim 4, wherein the stabilized amorphous compound is in a spray dried dispersion with a polymer.
7. The solid oral dosage form of claim 6, wherein the polymer is selected from the group consisting of hydroxypropylmethyl cellulose (HPMC), hydroxypropylmethyl cellulose acetate succinate (HPMC AS), hydroxypropyl methyl cellulose phthalate (HPMCP), hydroxypropyl cellulose (HPC), ethylcellulose, cellulose acetate phthalate, polyvinylpyrrolidone (PVP), and a combination thereof.
8. The solid oral dosage form of claim 6, wherein the polymer is HPMC AS.

9. The solid oral dosage form of claim 8, wherein the (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one is spray dried with HPMC AS in a weight ratio of 1:3 to 2:1.
10. The solid oral dosage form of claim 8, wherein the (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one is spray dried with HPMC AS in a weight ratio of 1:1.
11. A (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one active pharmaceutical ingredient (API) composition comprising 0.05-5.0% by HPLC of (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one.
12. A tablet comprising 200 mg of stabilized amorphous compound (S)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one as the active pharmaceutical ingredient (API), wherein the stabilized amorphous compound does not show crystallinity by PXRD (Method D) after 2 weeks of storage of the tablet at 60 °C/75% RH (exposed).
13. The tablet of claim 12, wherein the API comprises less than 5.0% by HPLC of (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one.
14. The tablet of claim 13, wherein the API comprises less than 0.05% by HPLC of (R)-1-(5-[2H,3H-[1,4]dioxino[2,3-b]pyridine-7-sulfonyl]-1H,2H,3H,4H,5H,6H-pyrrolo[3,4-c]pyrrol-2-yl)-3-hydroxy-2-phenylpropan-1-one.
15. The tablet of claim 12, having a total weight of less than 800 mg.

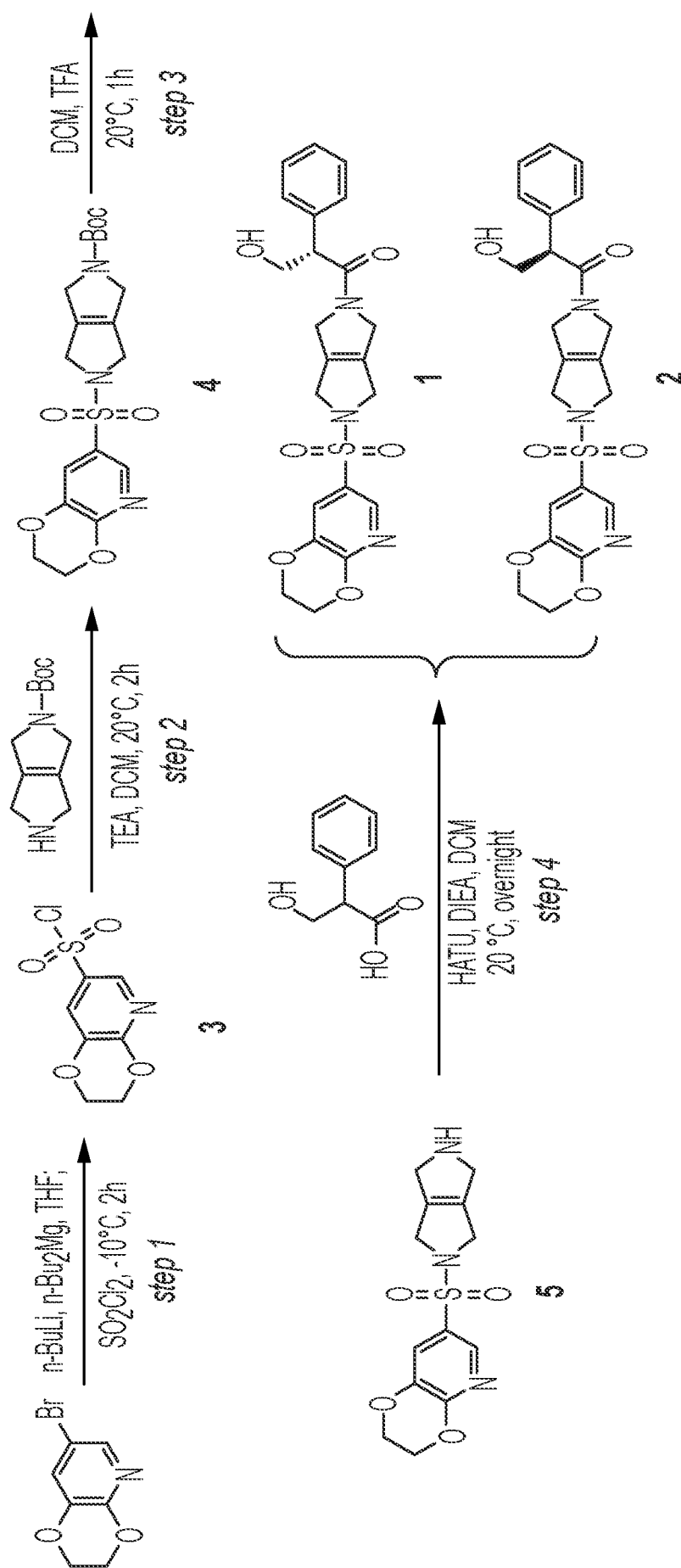


Figure 1

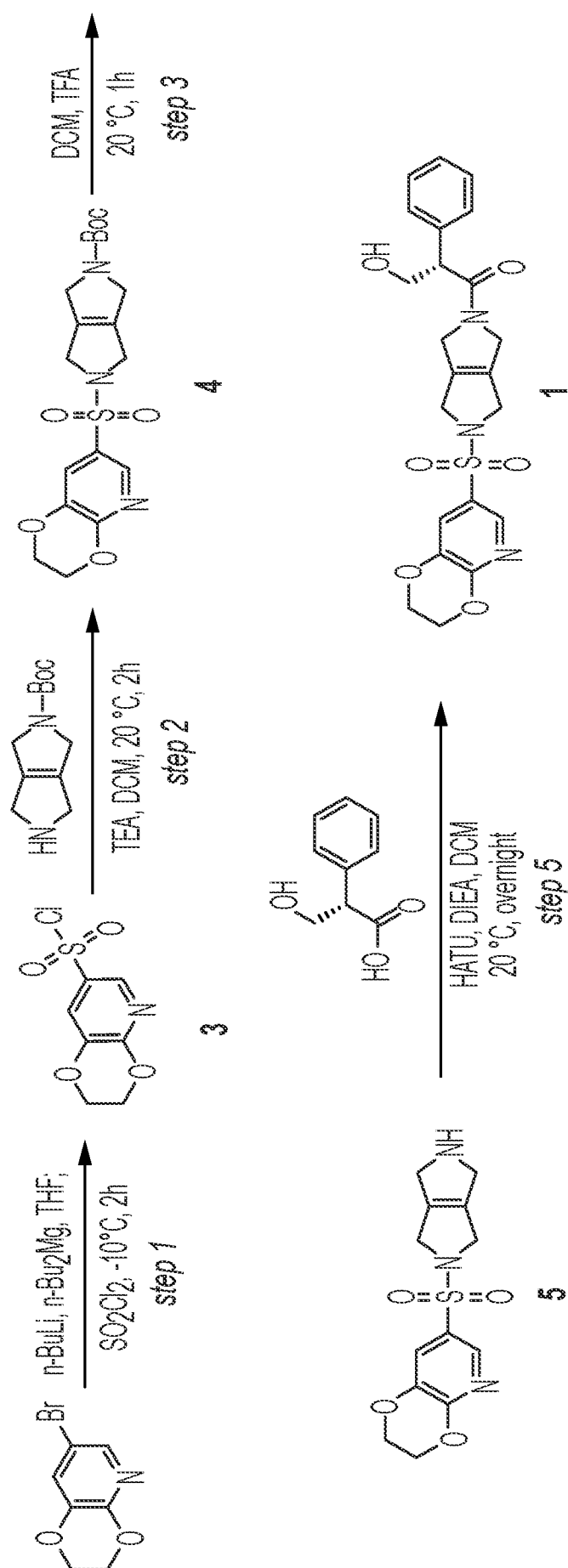


Figure 2

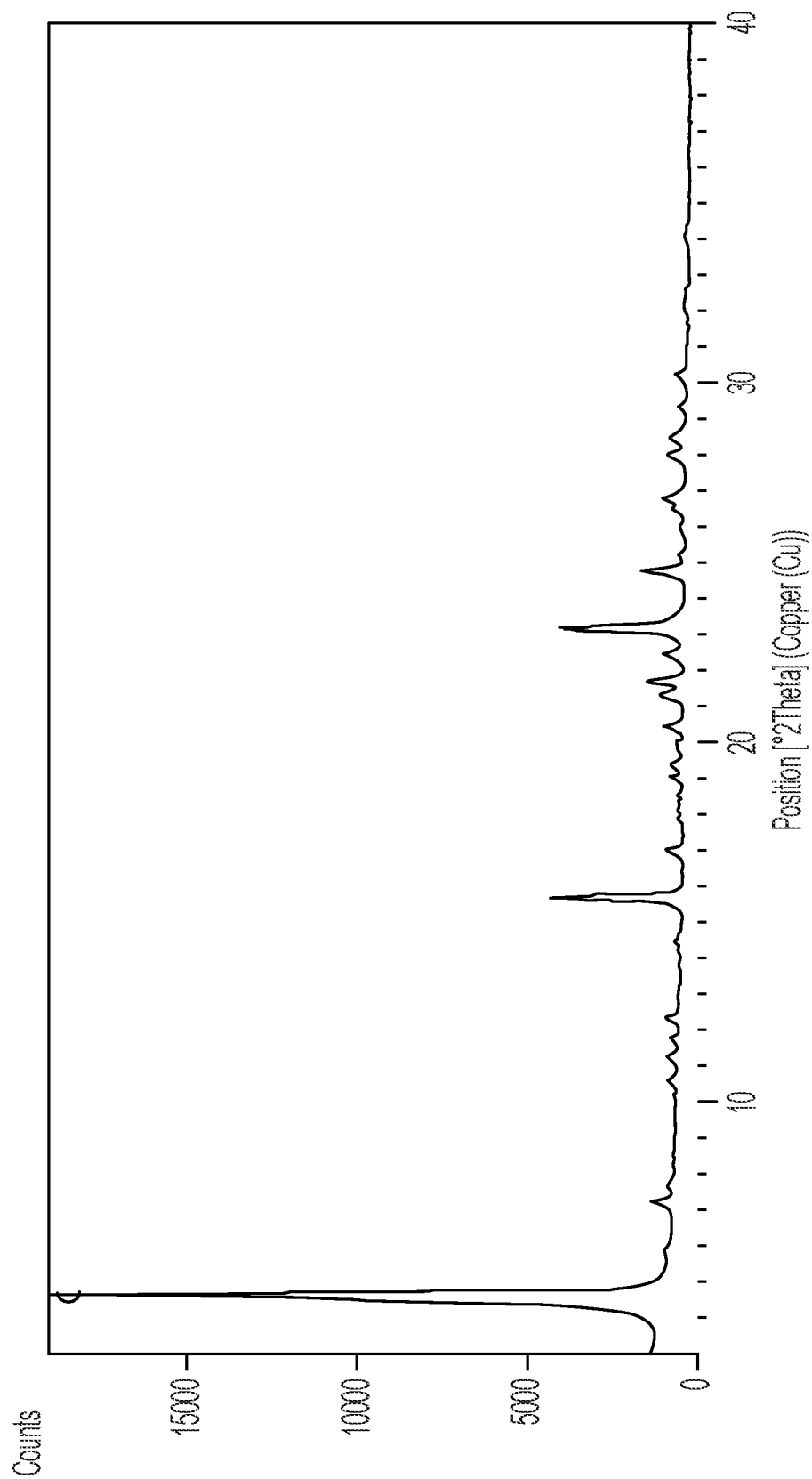


Figure 3

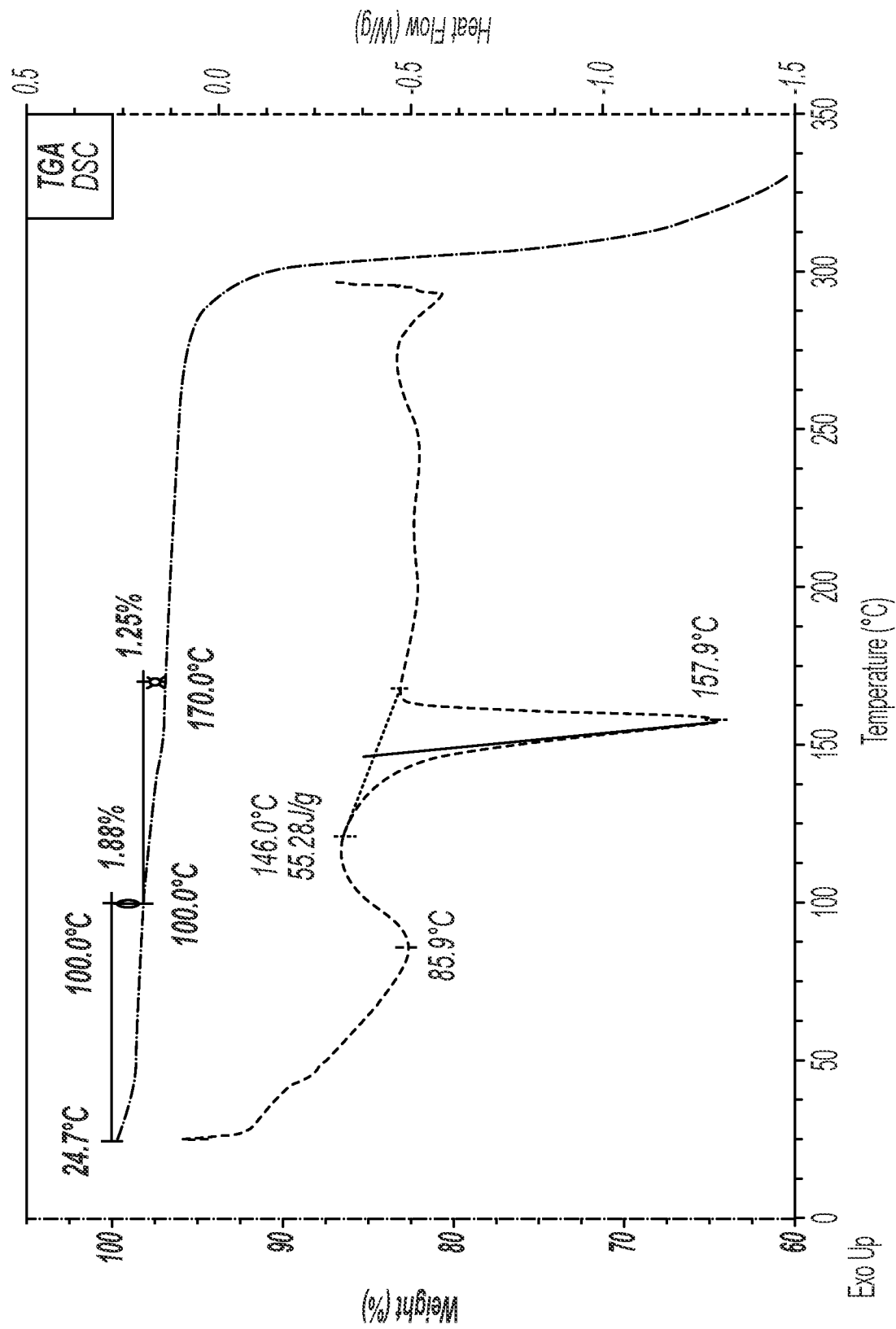


Figure 4

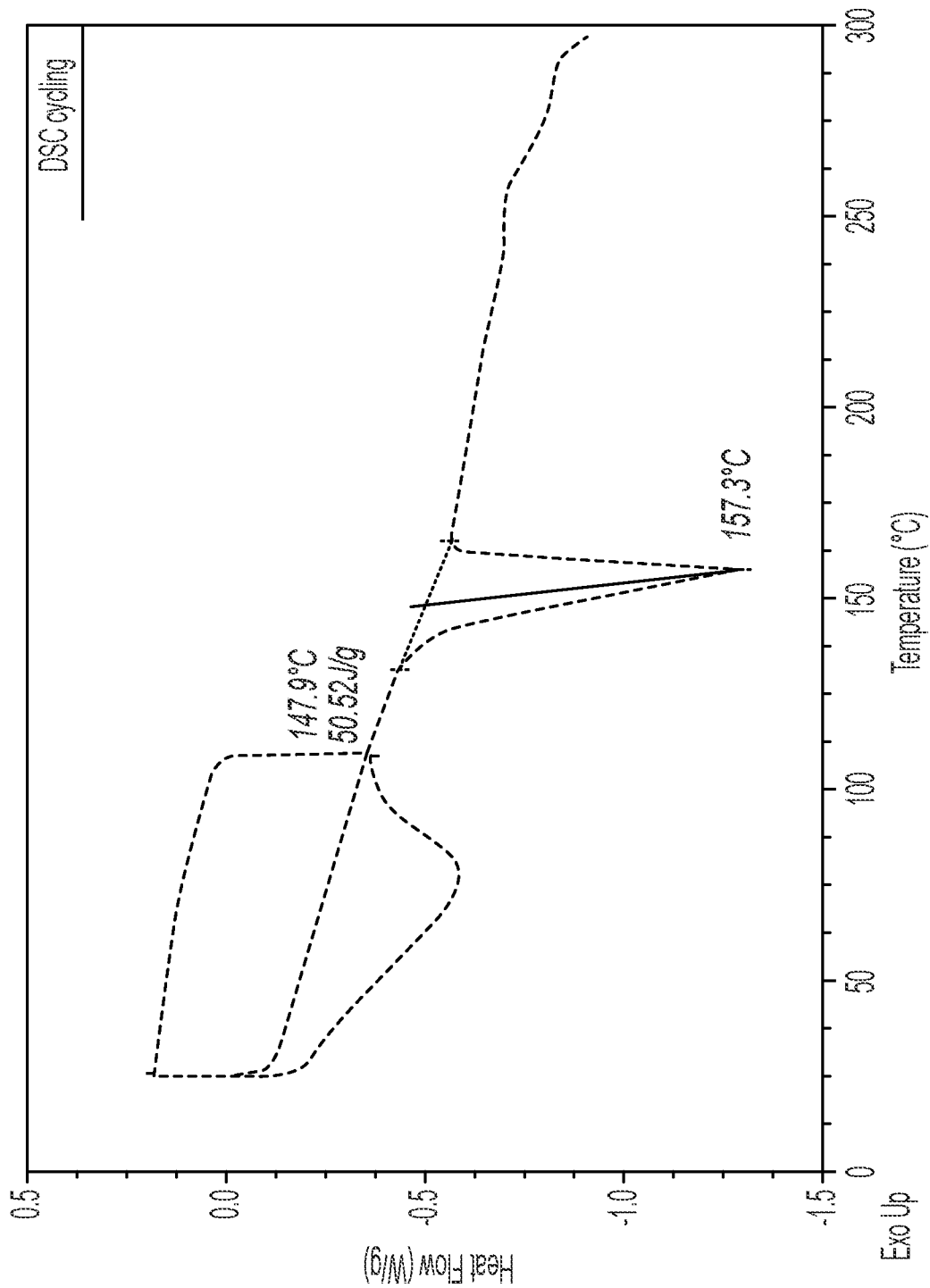


Figure 5

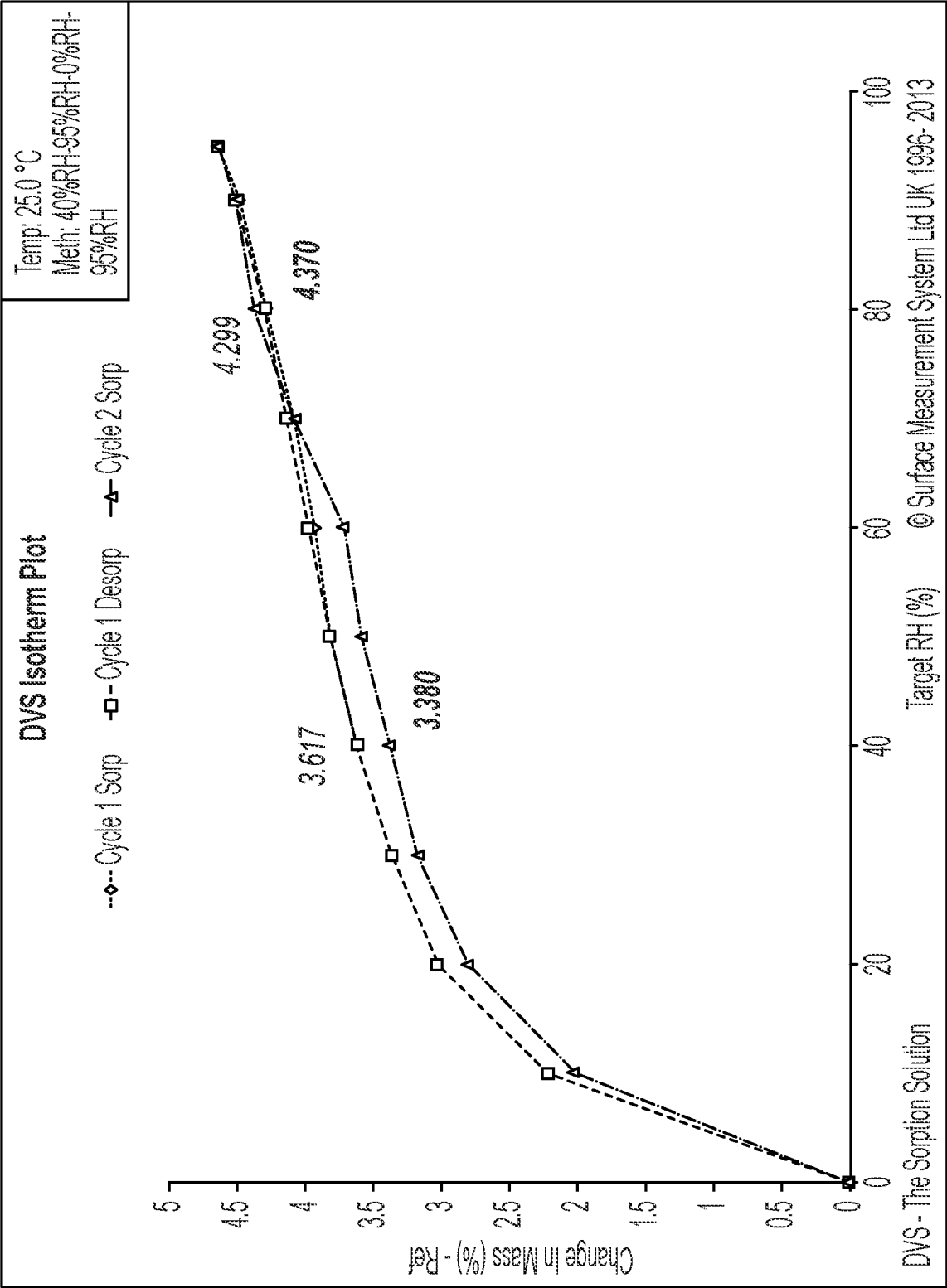


Figure 6

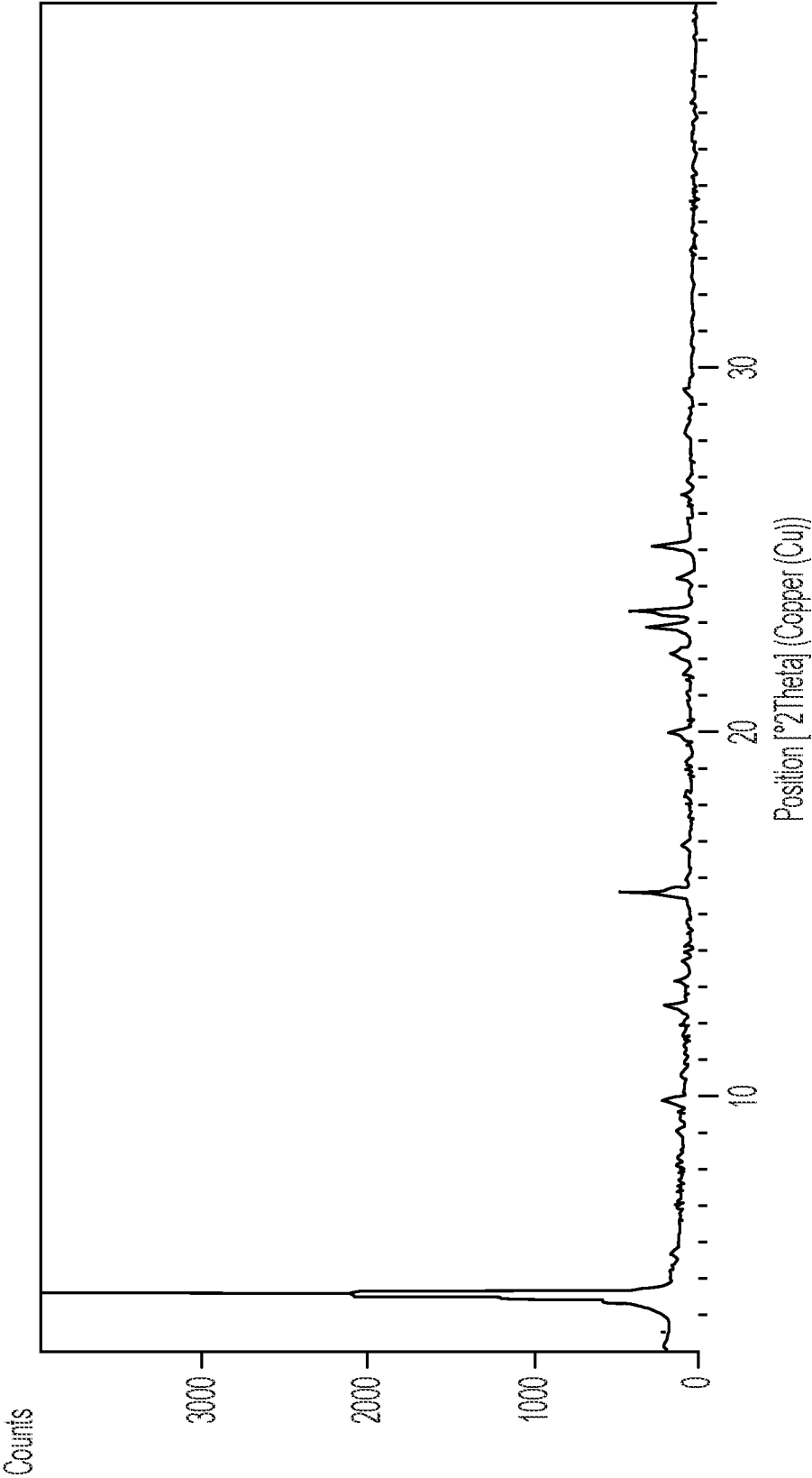


Figure 7

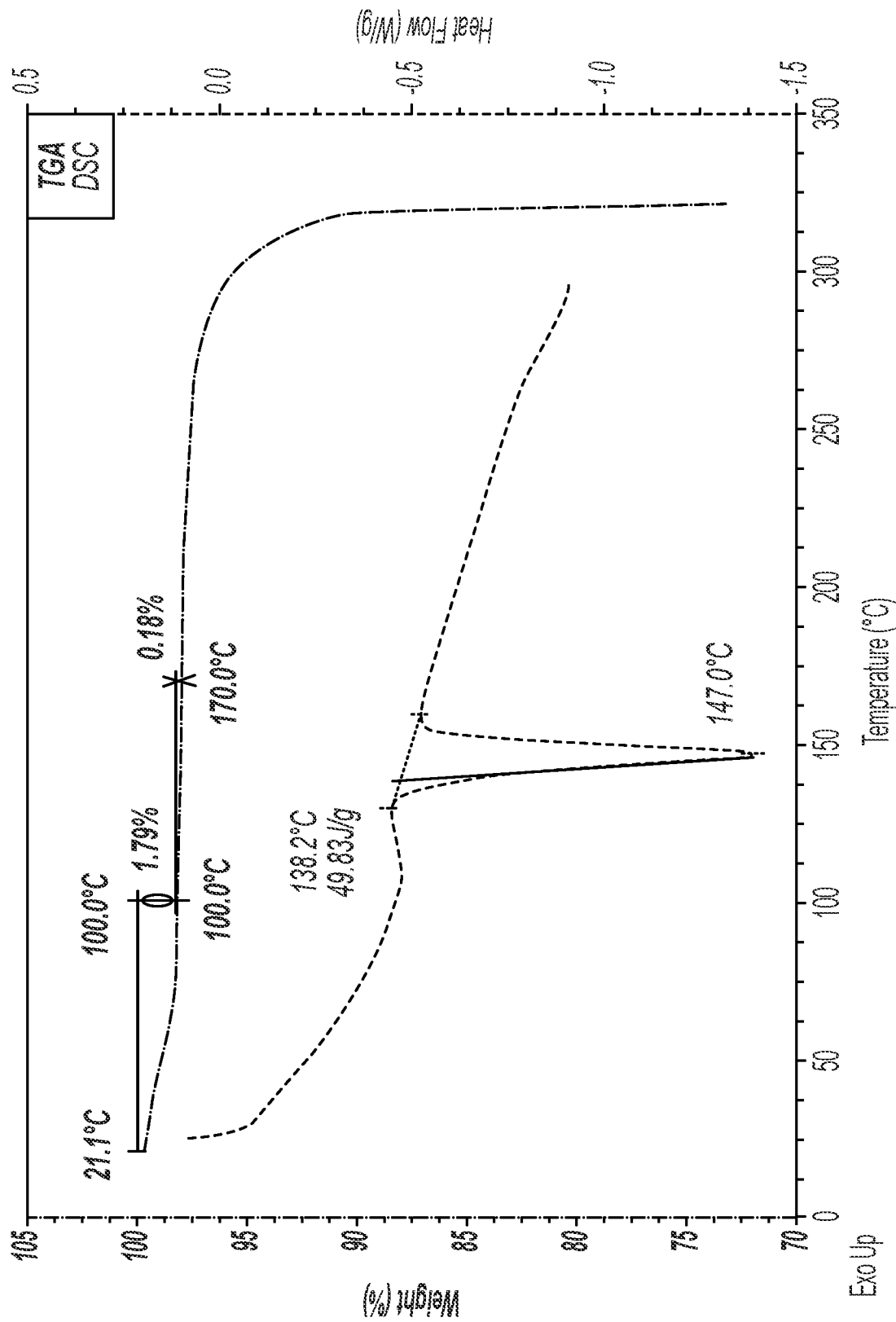


Figure 8

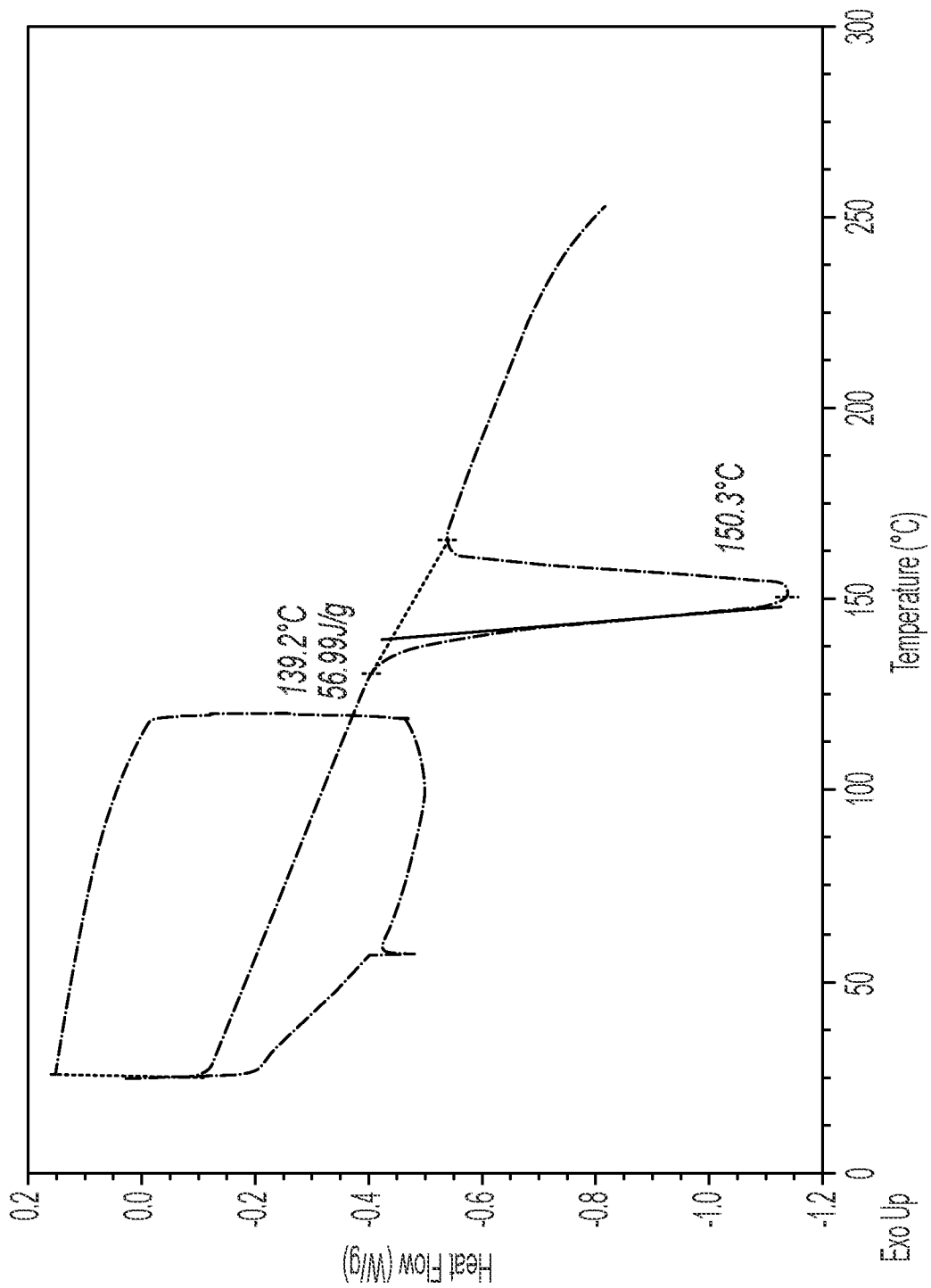


Figure 9

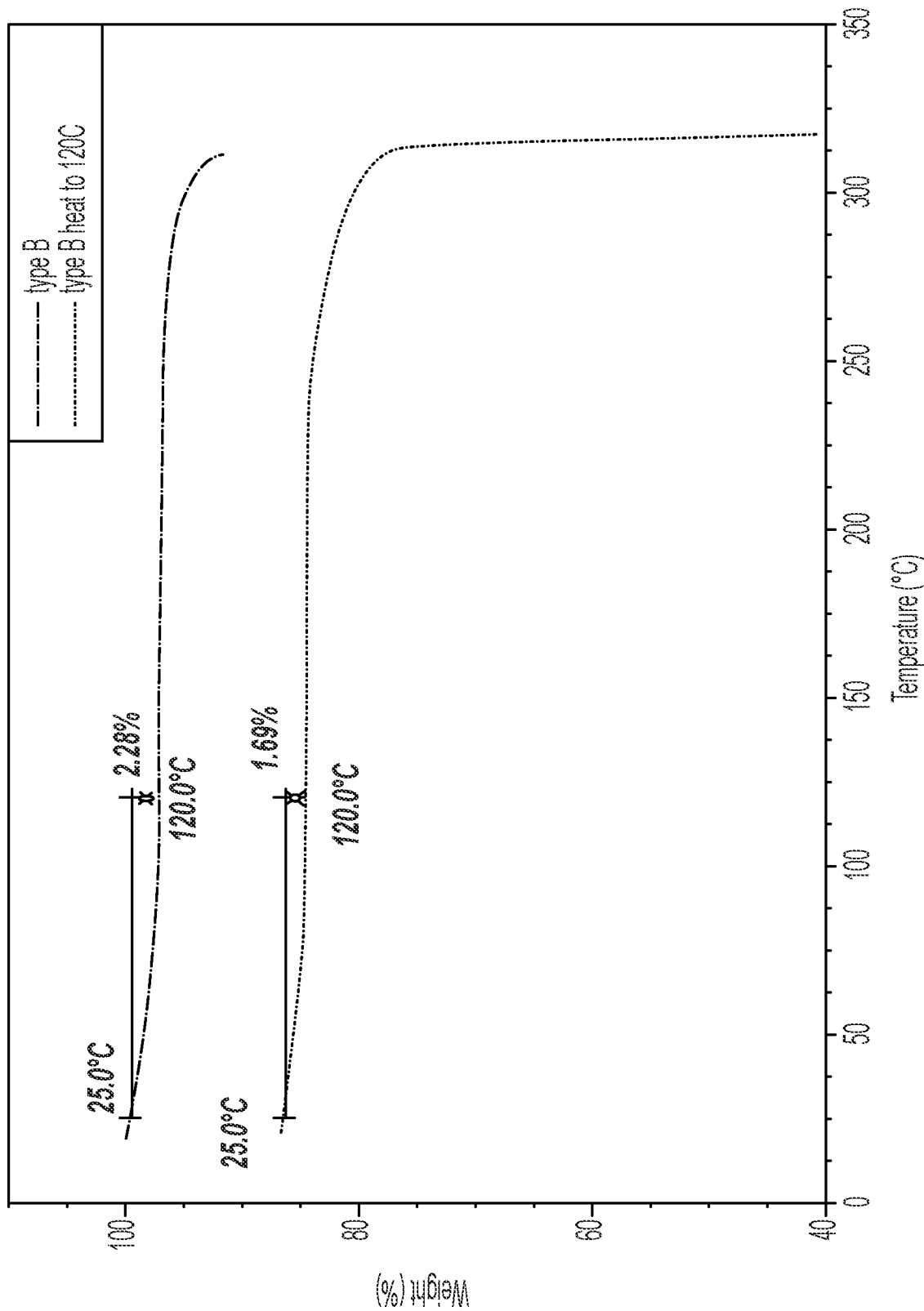


Figure 10

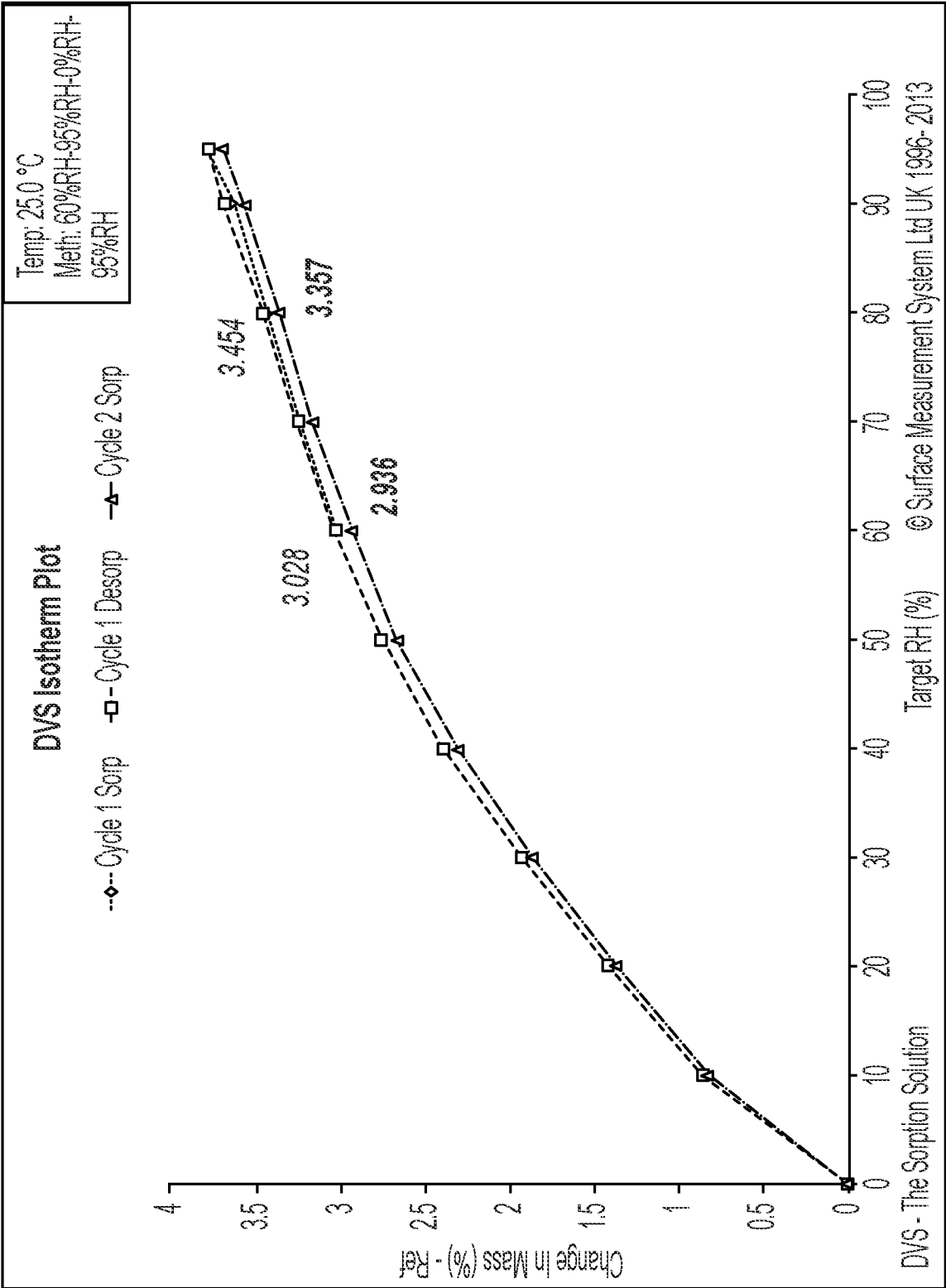


Figure 11

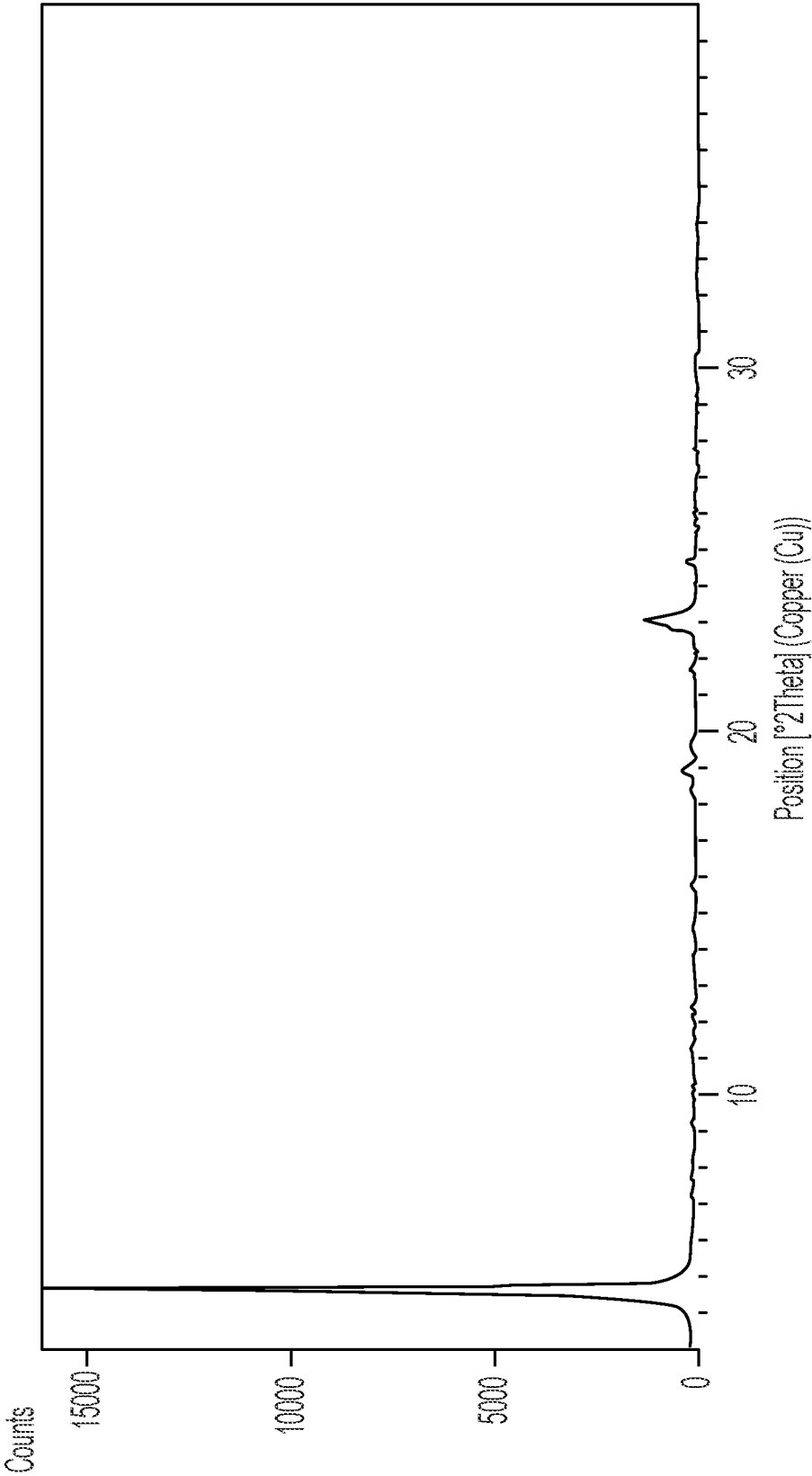


Figure 12

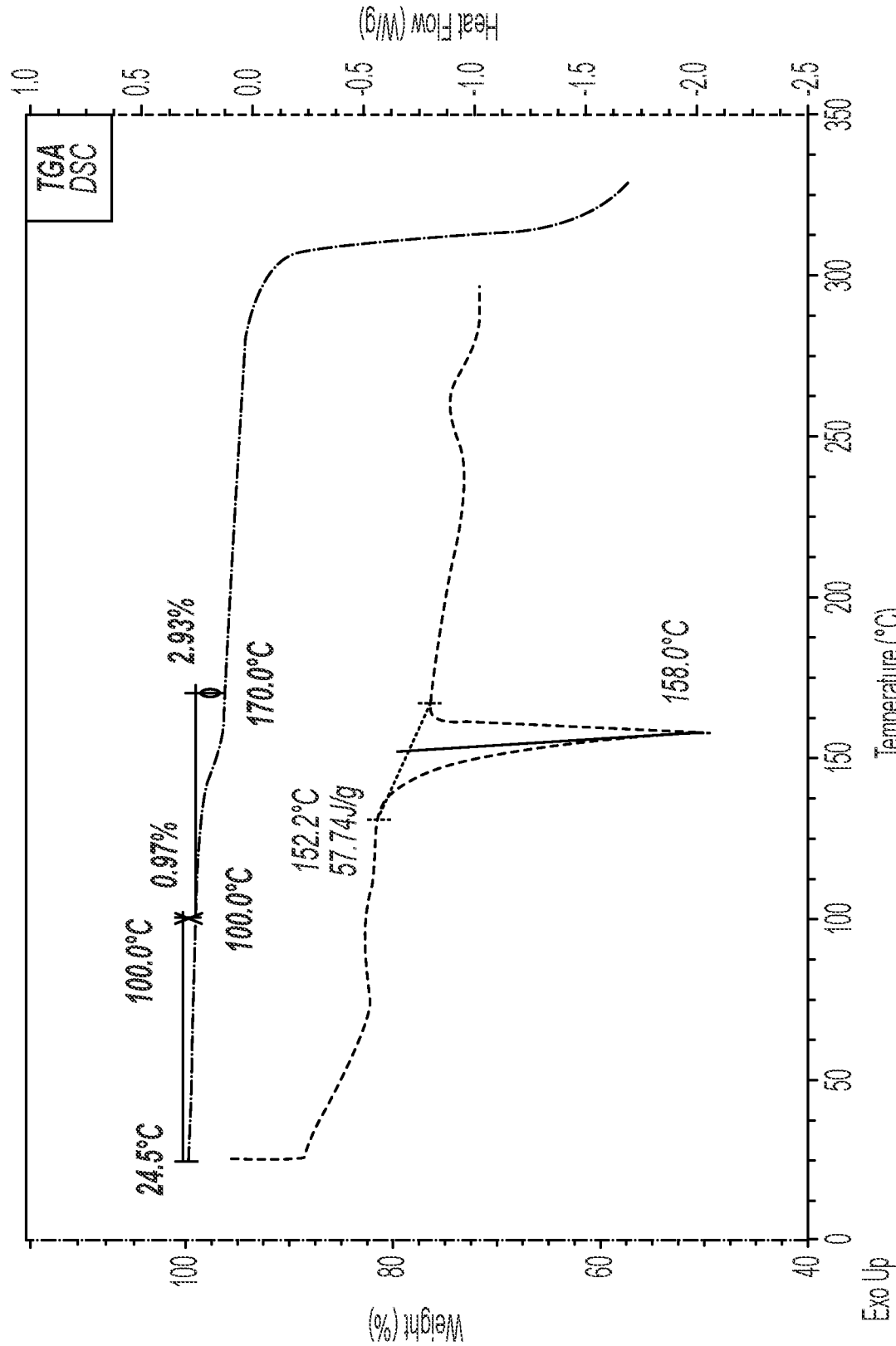


Figure 13

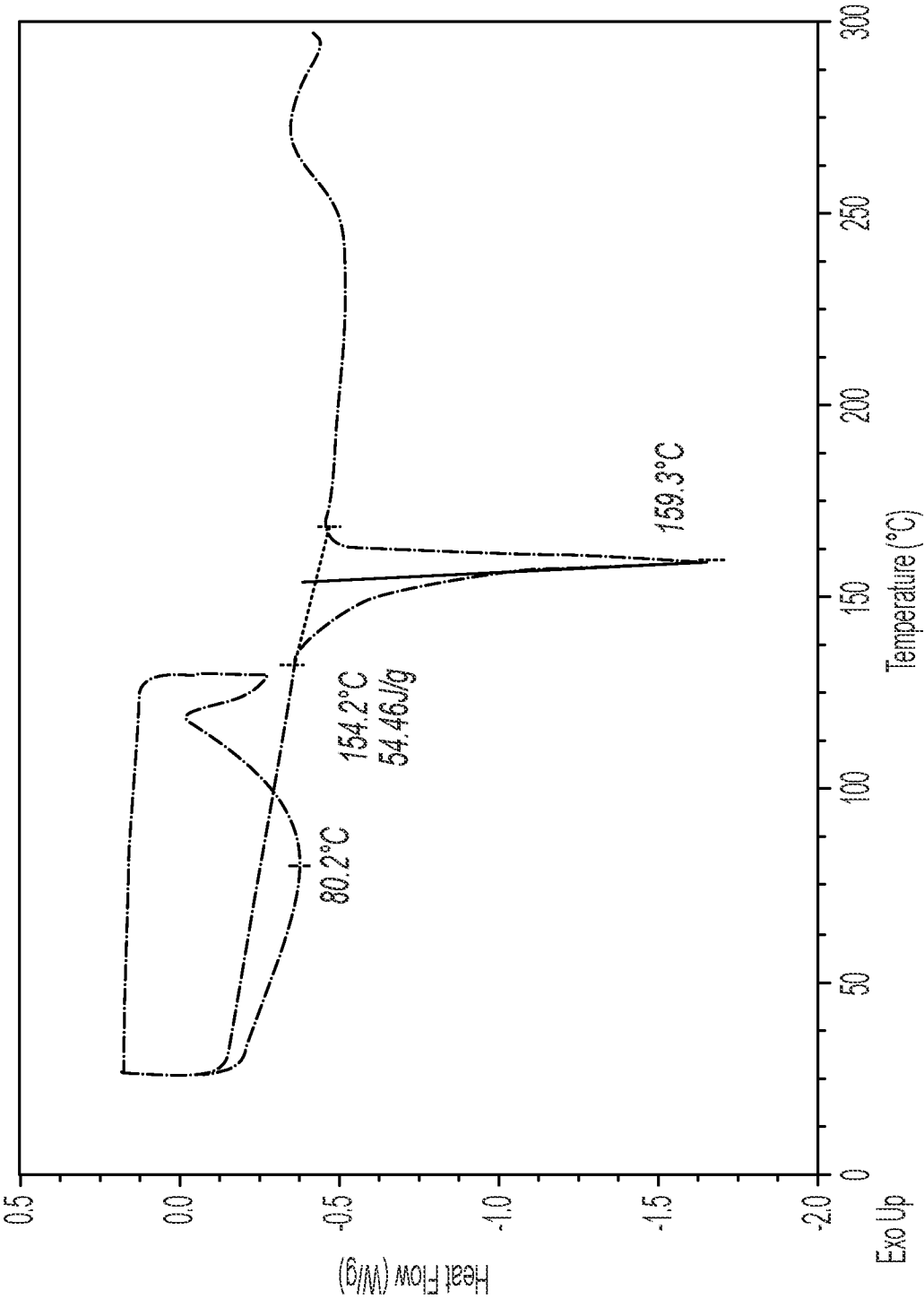


Figure 14

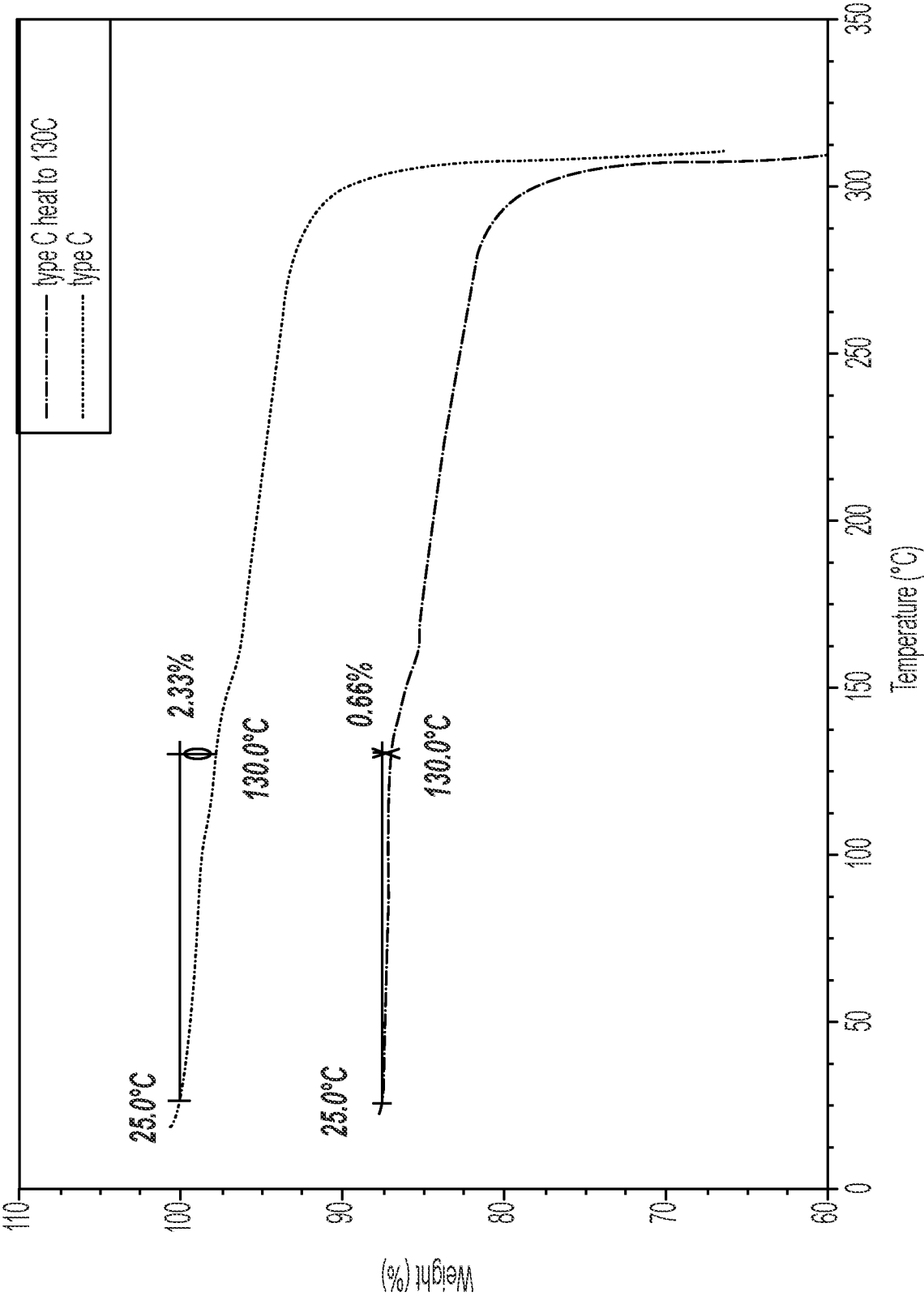


Figure 15

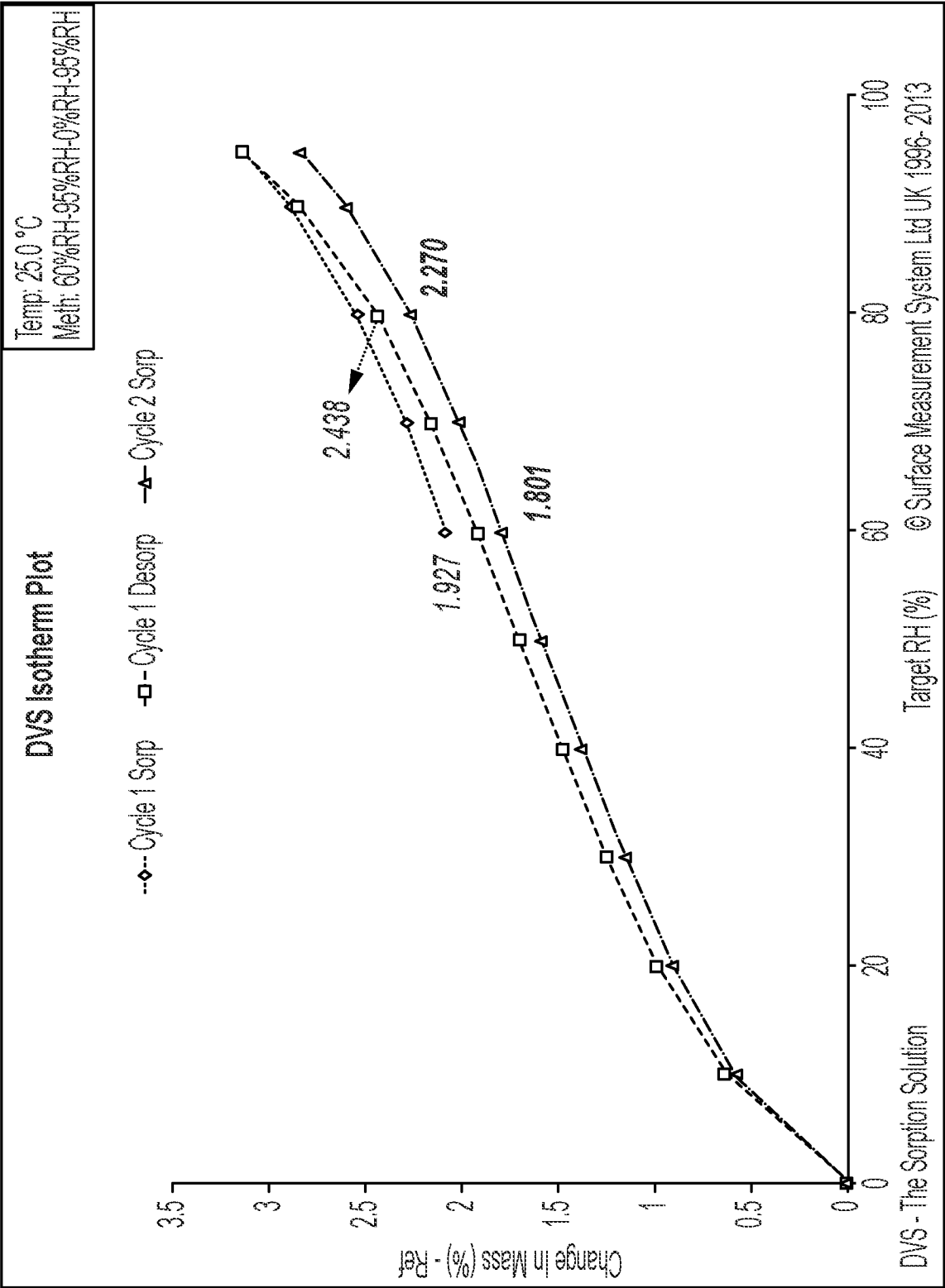


Figure 16

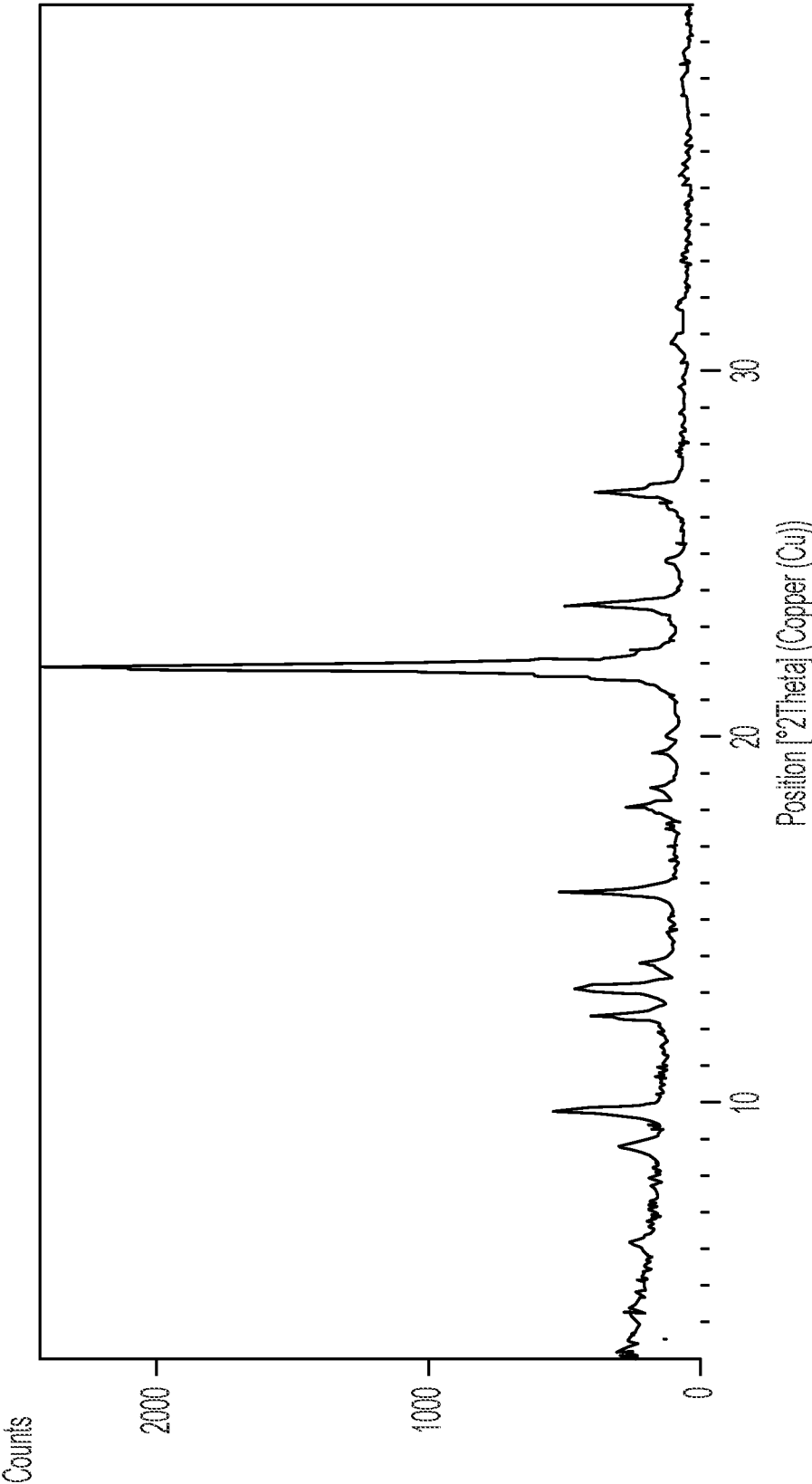


Figure 17

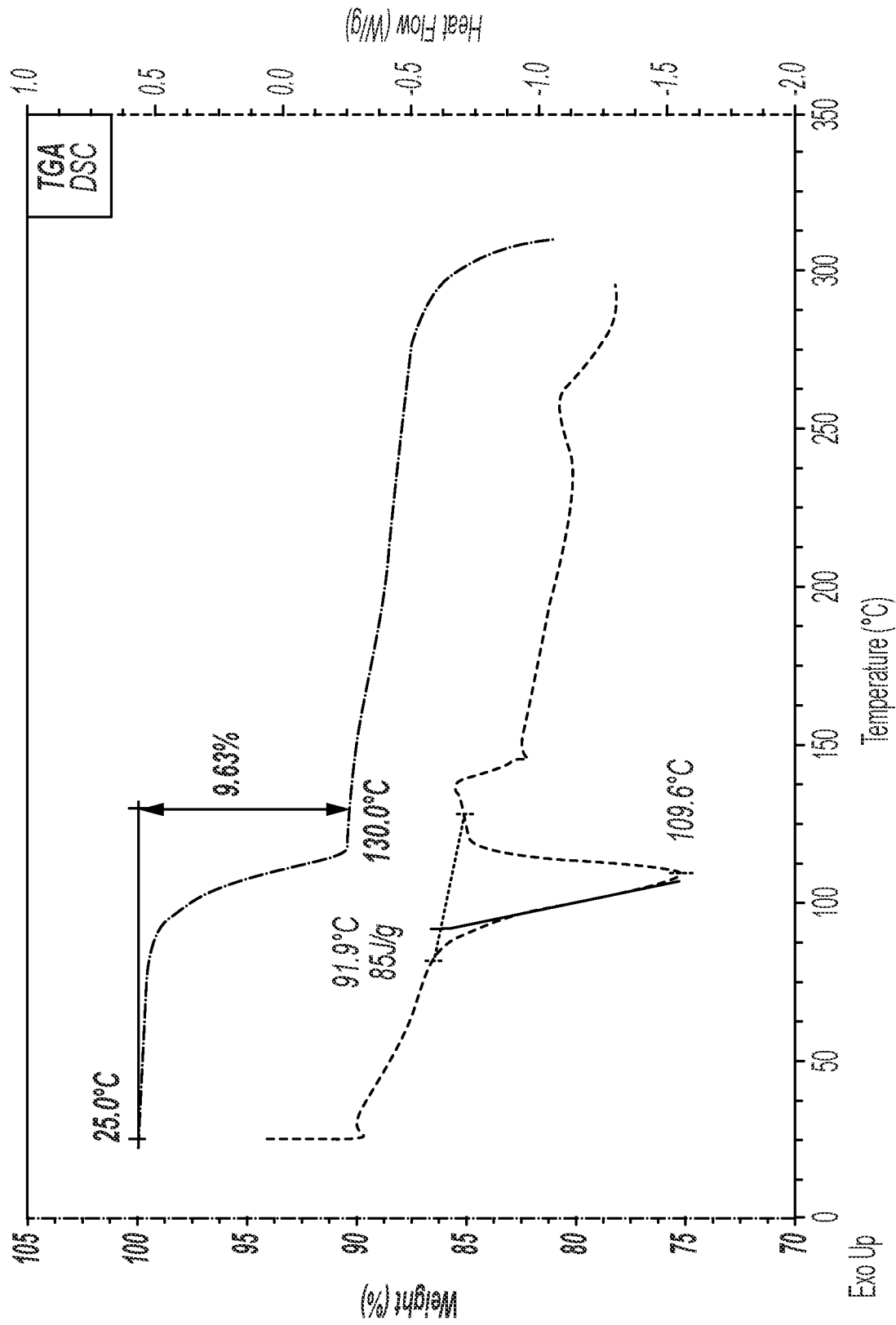


Figure 18

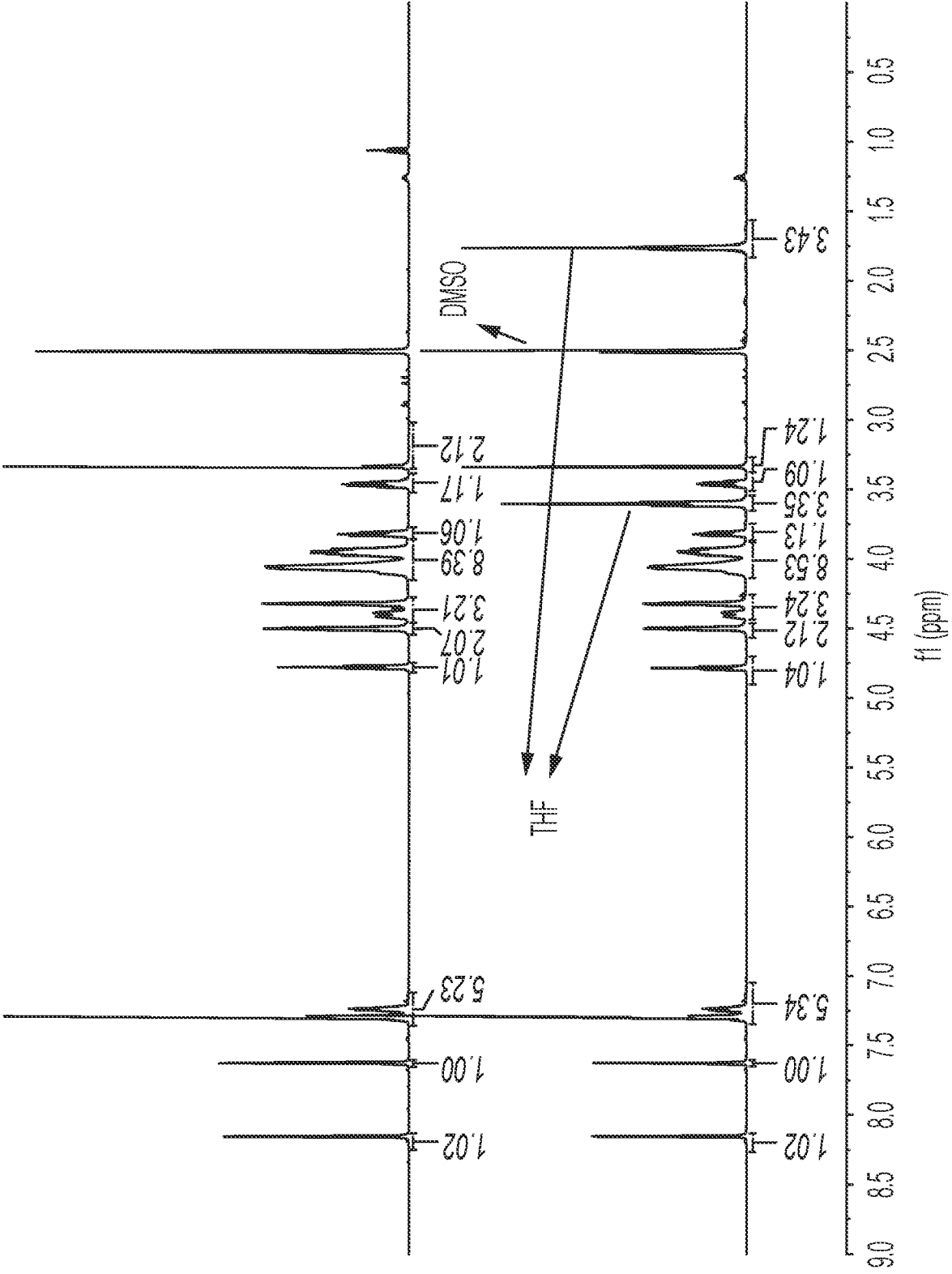


Figure 19

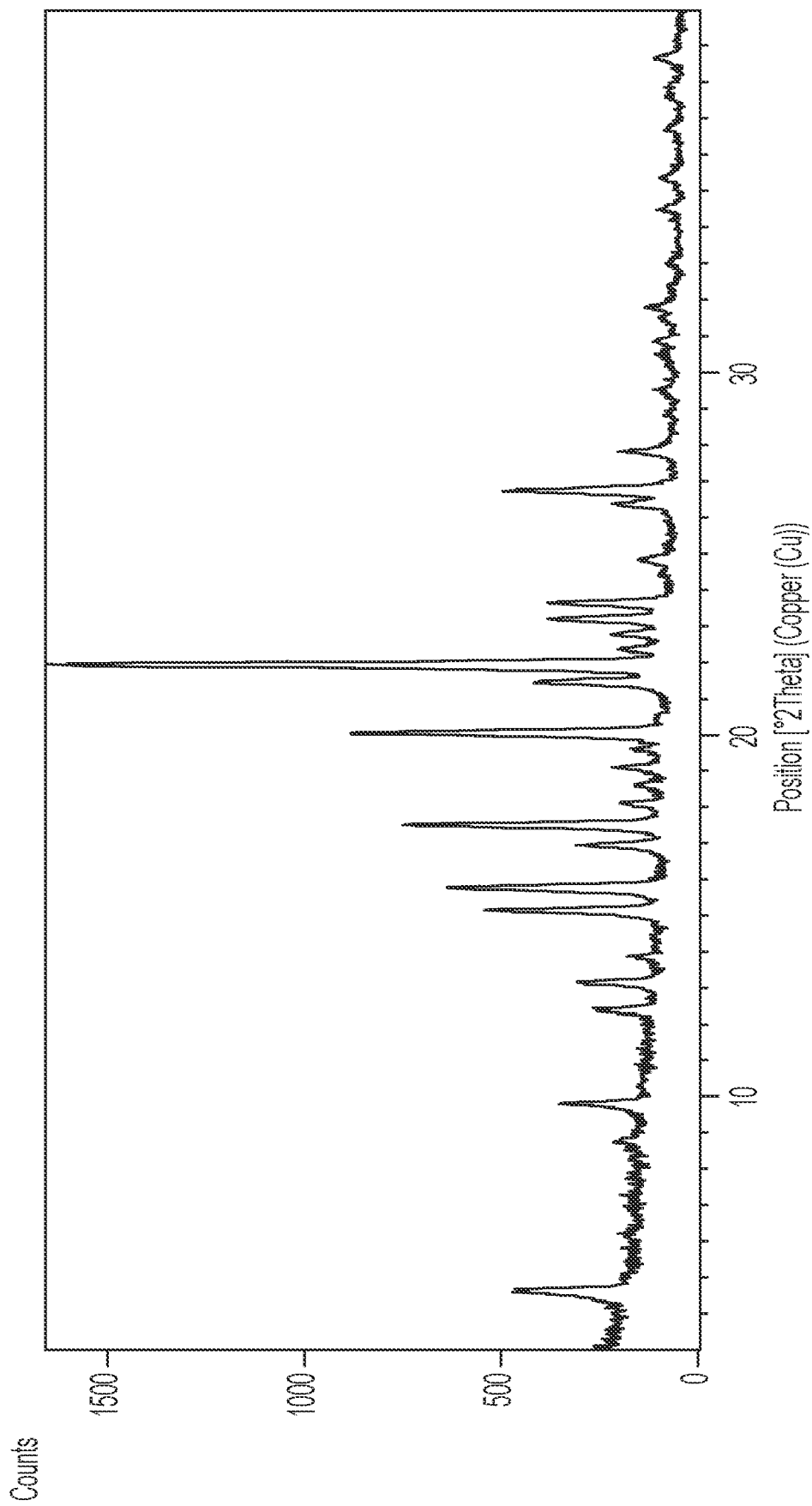


Figure 20

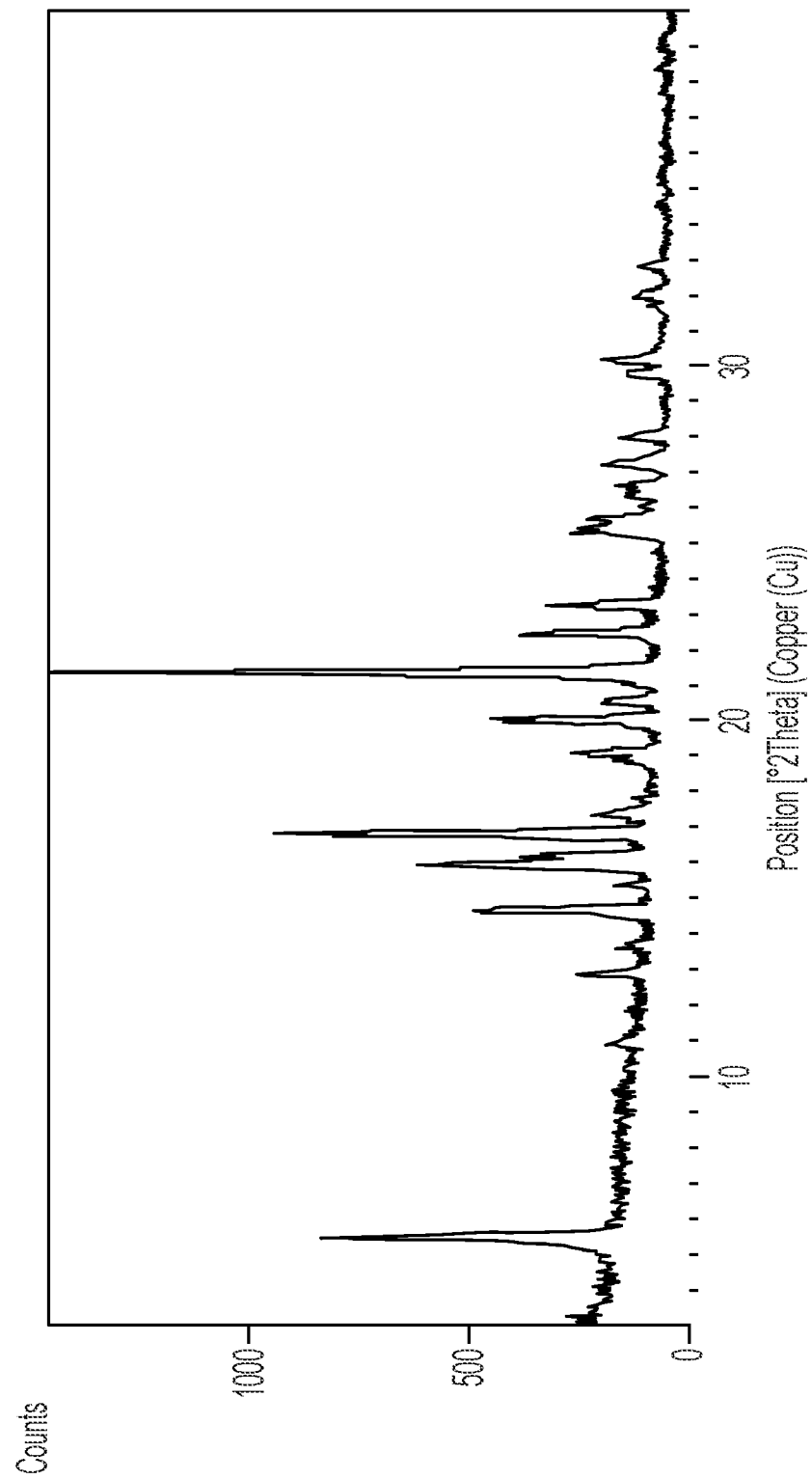


Figure 21

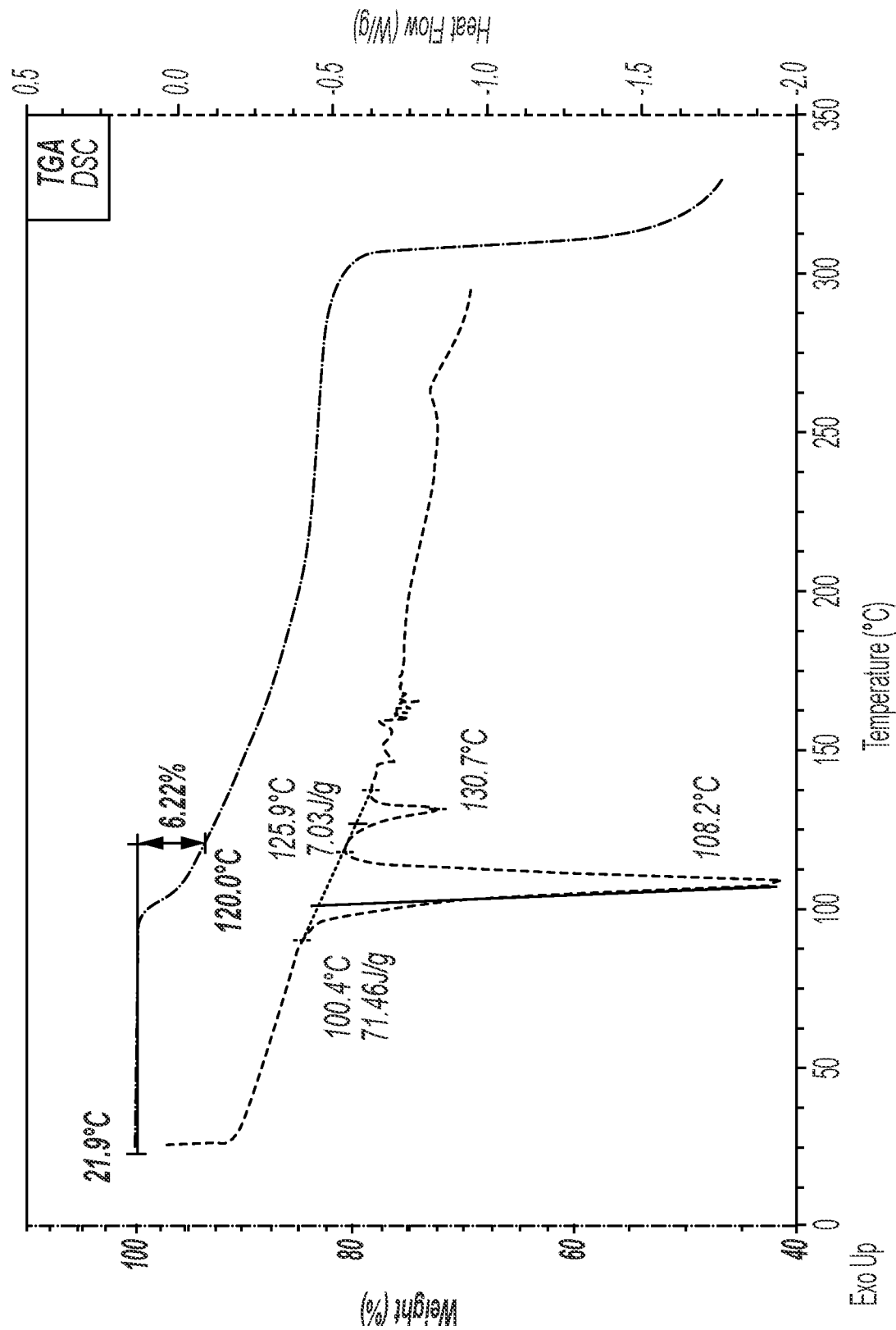


Figure 22

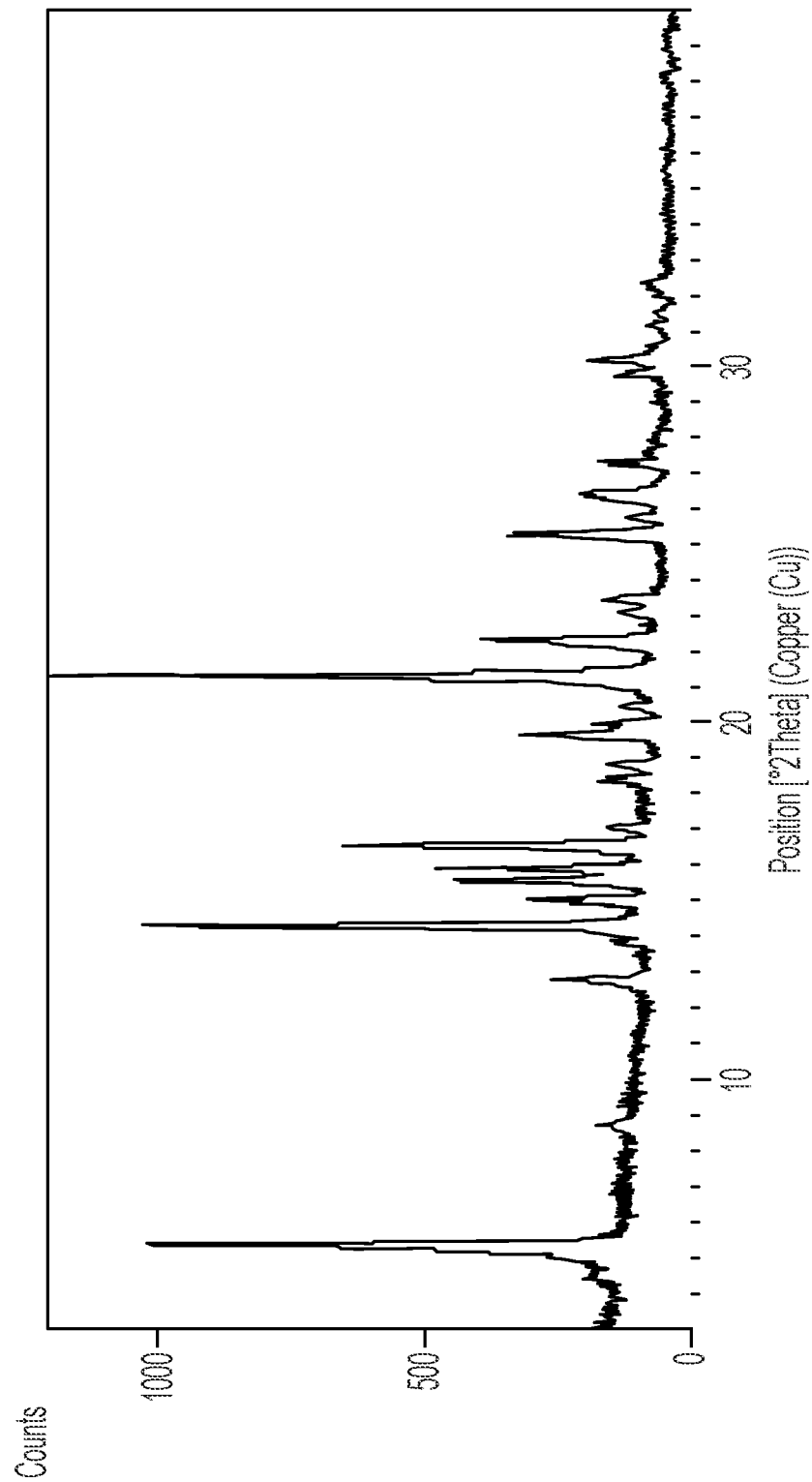


Figure 23

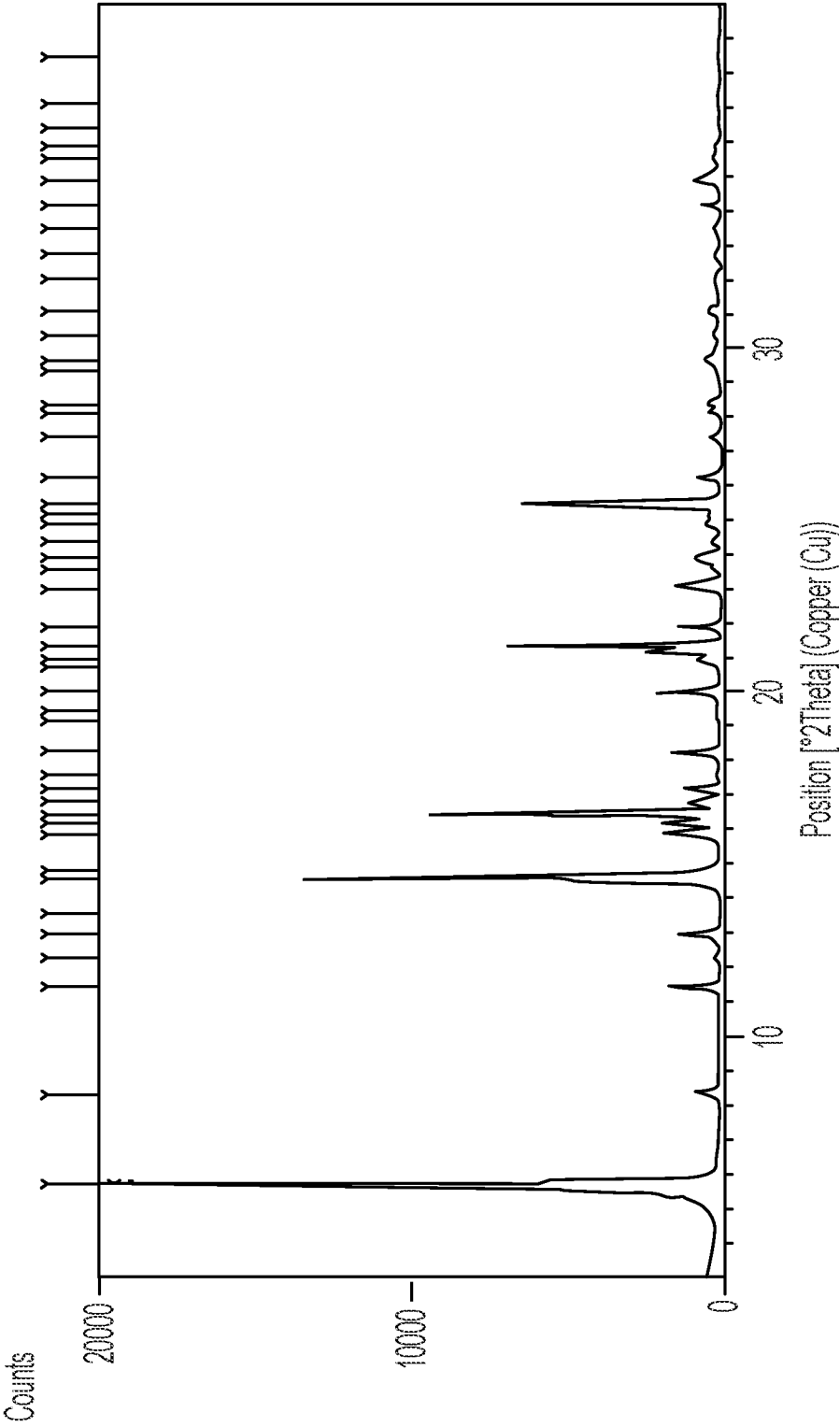


Figure 24

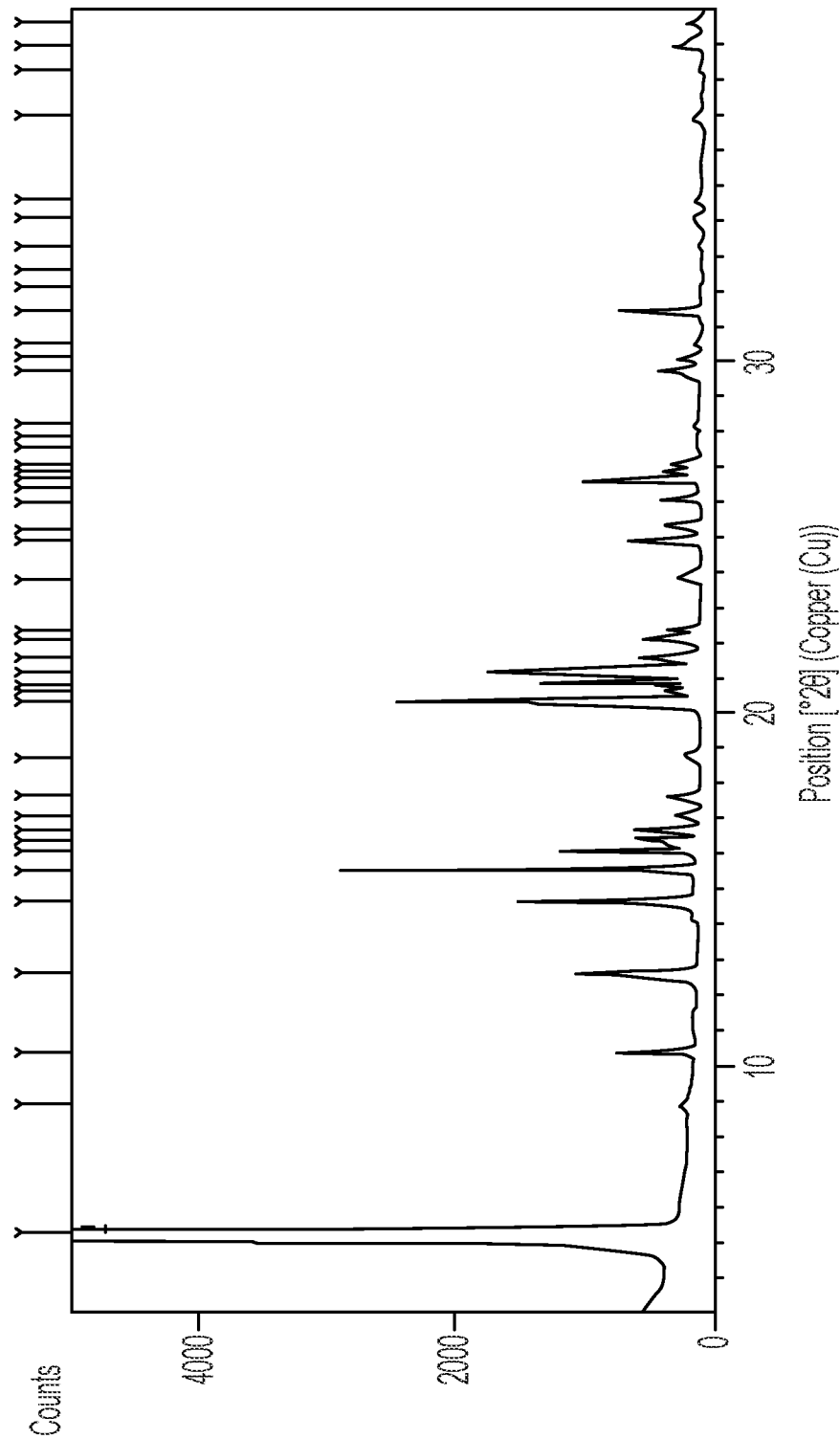


Figure 25

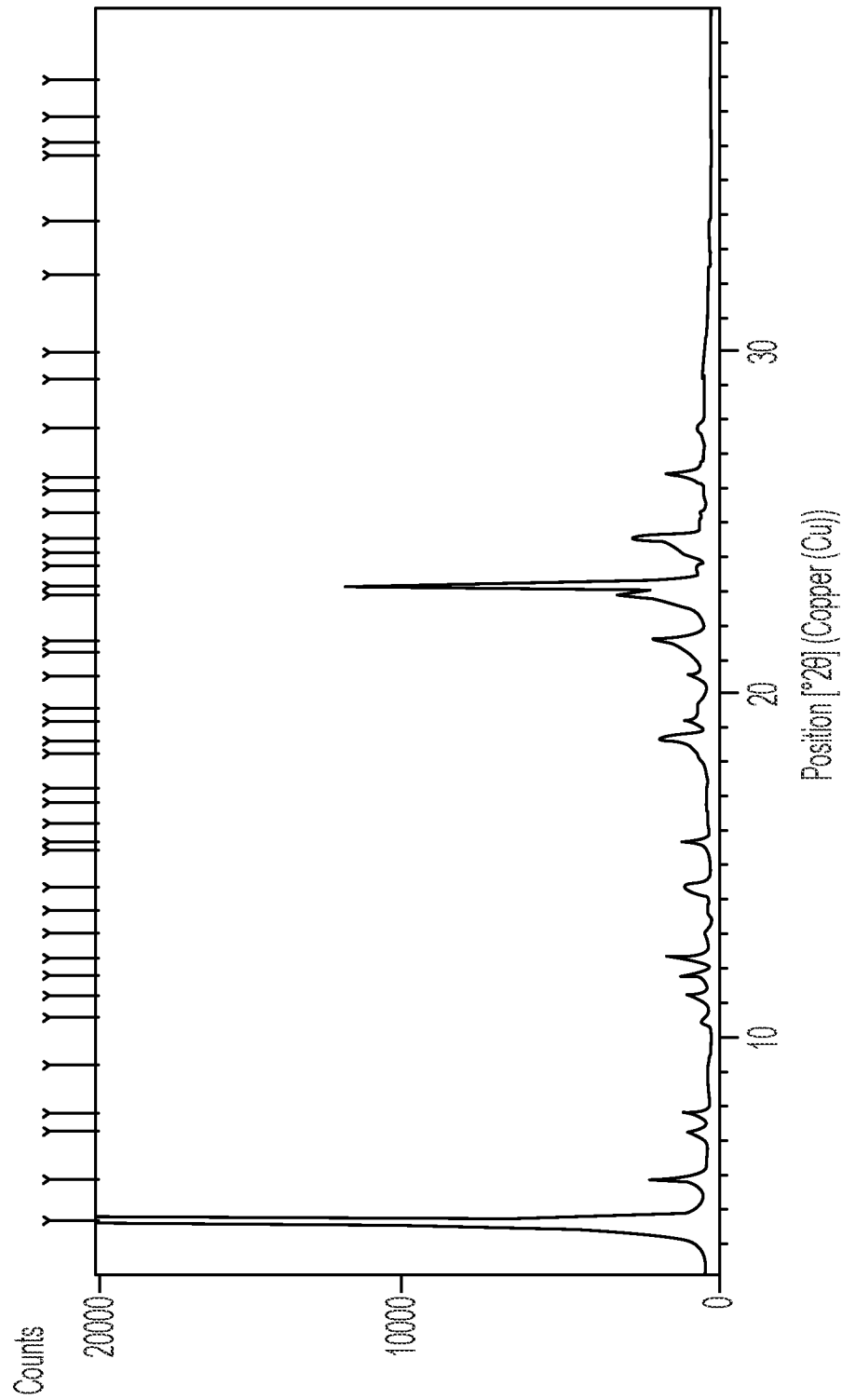


Figure 26

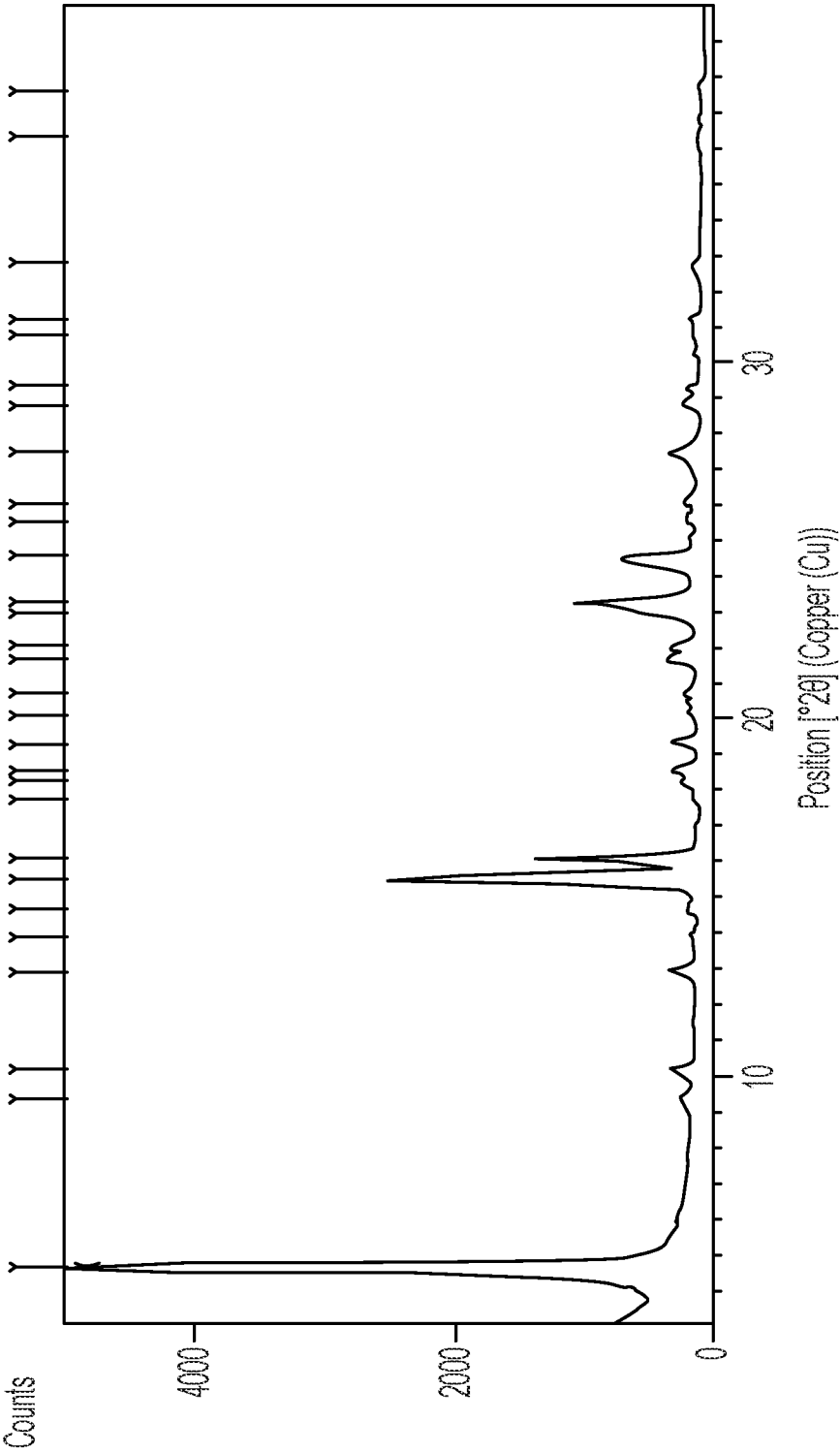


Figure 27

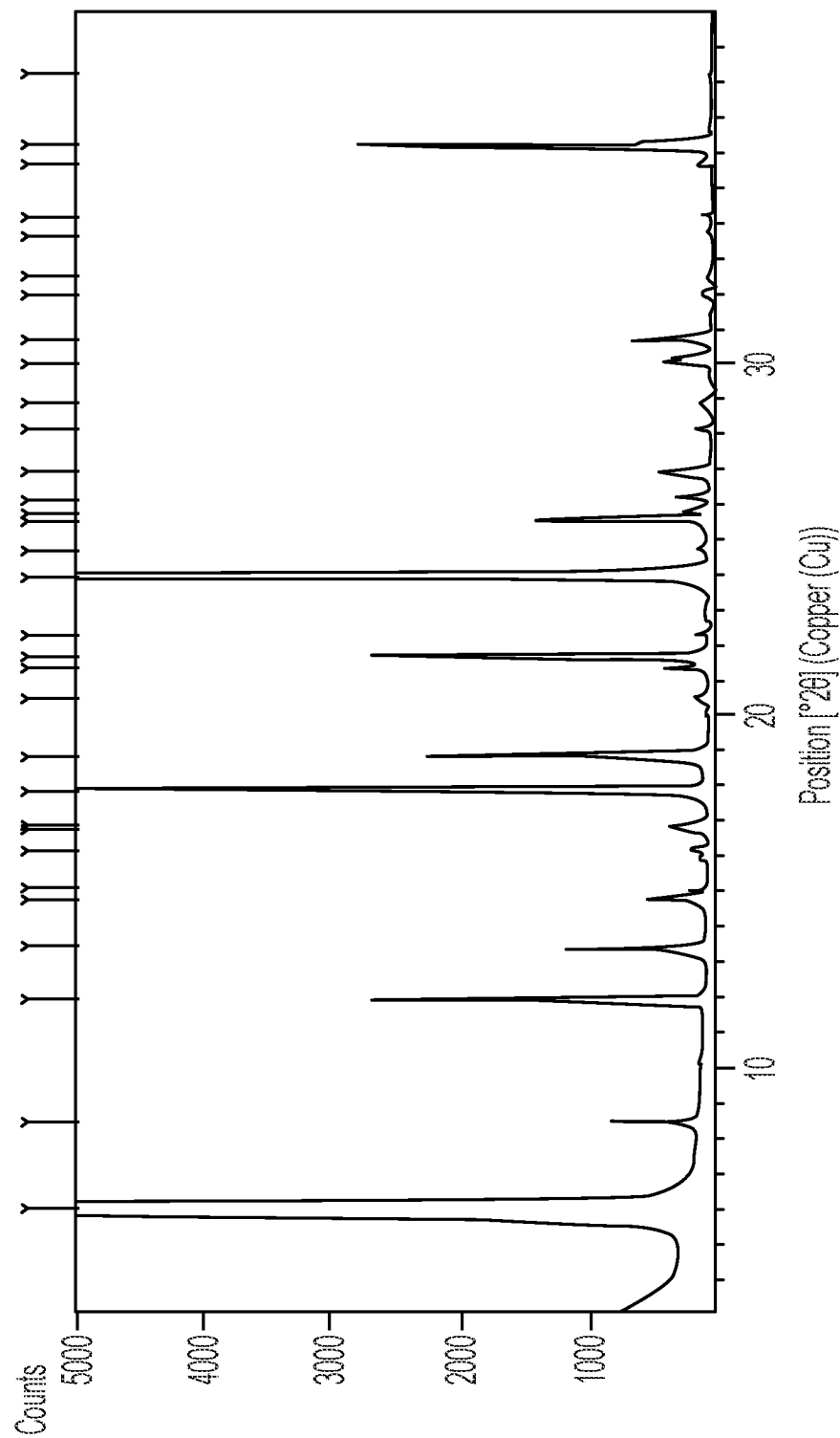


Figure 28

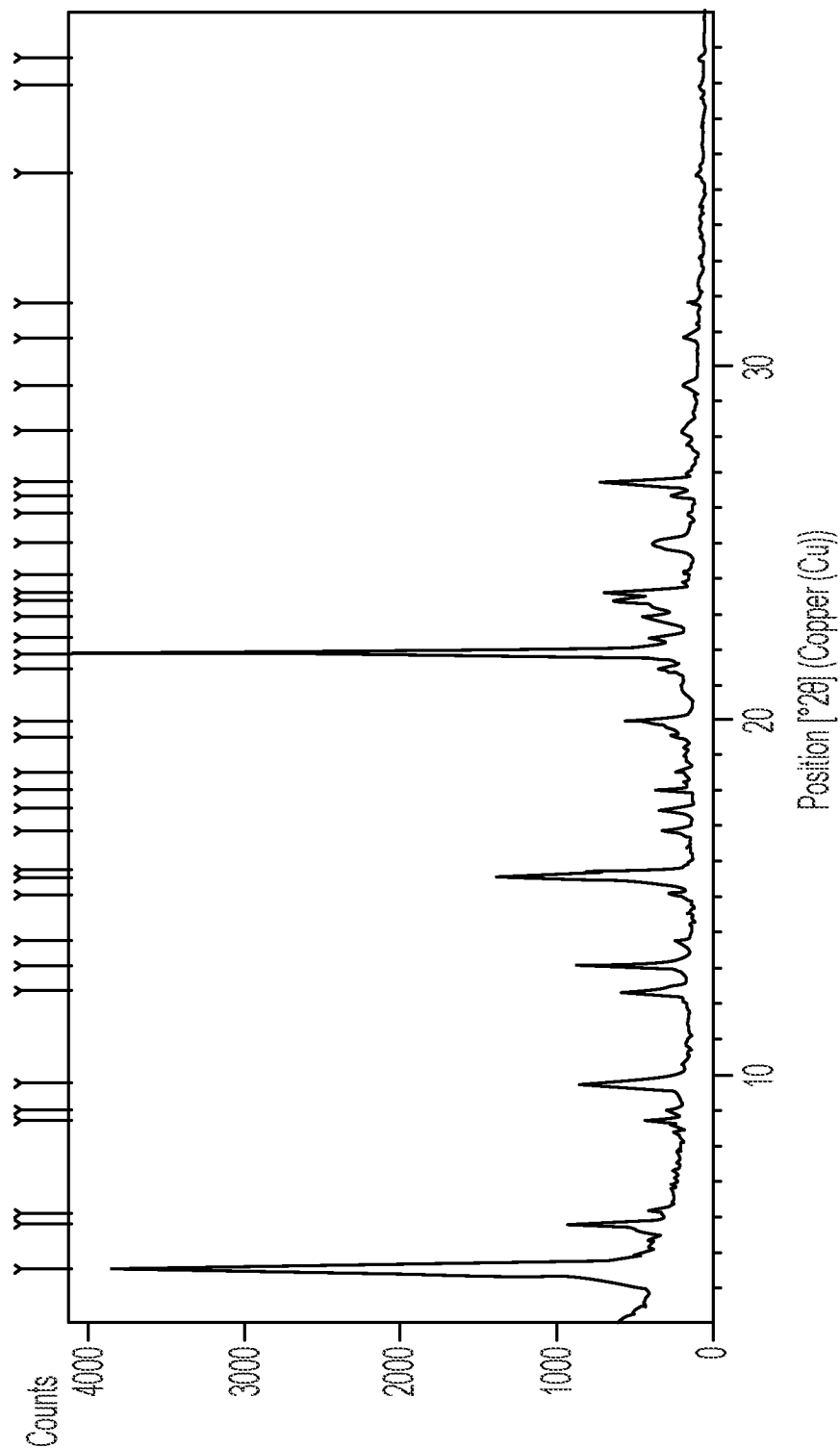


Figure 29

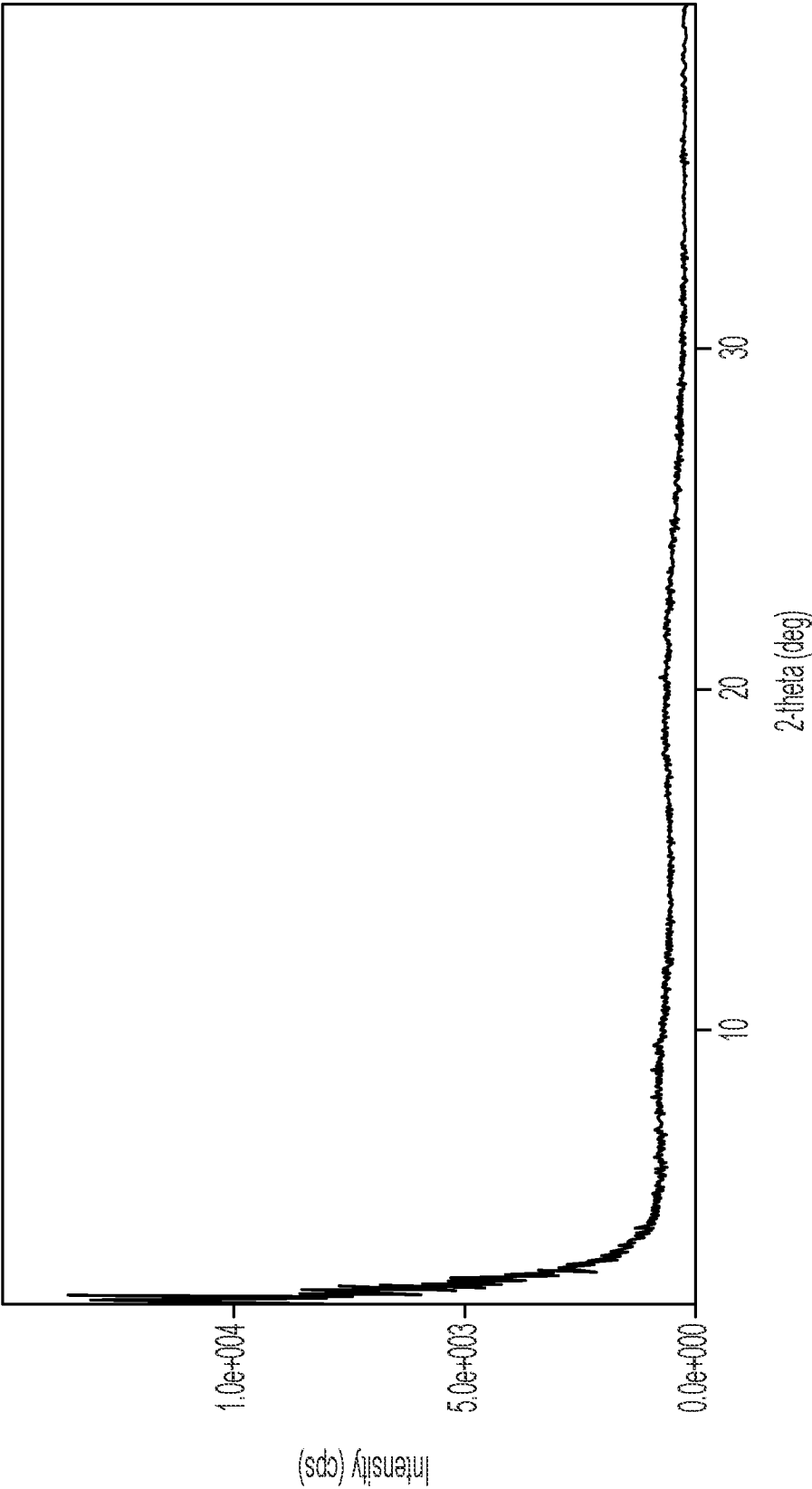


Figure 30

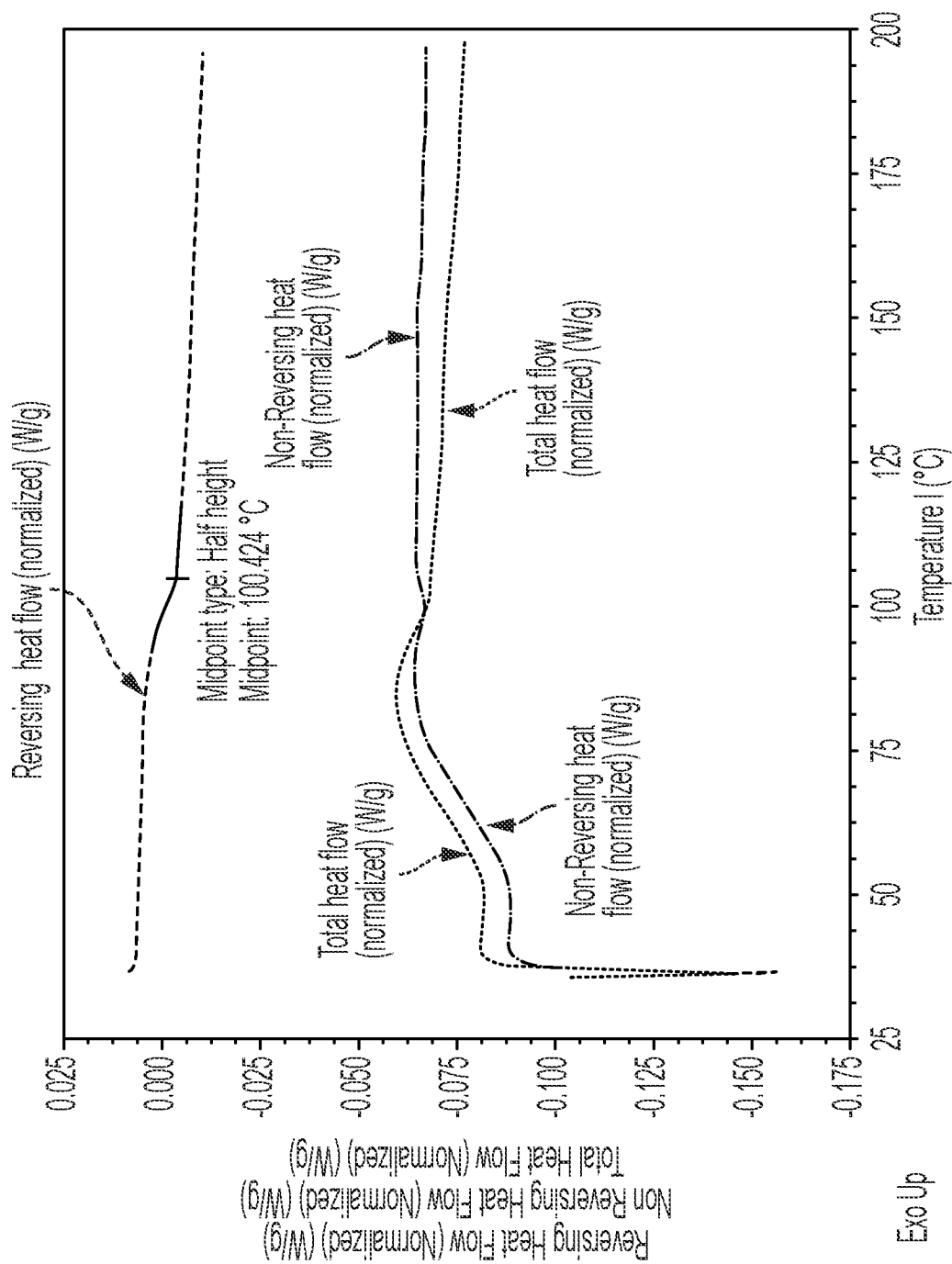


Figure 31

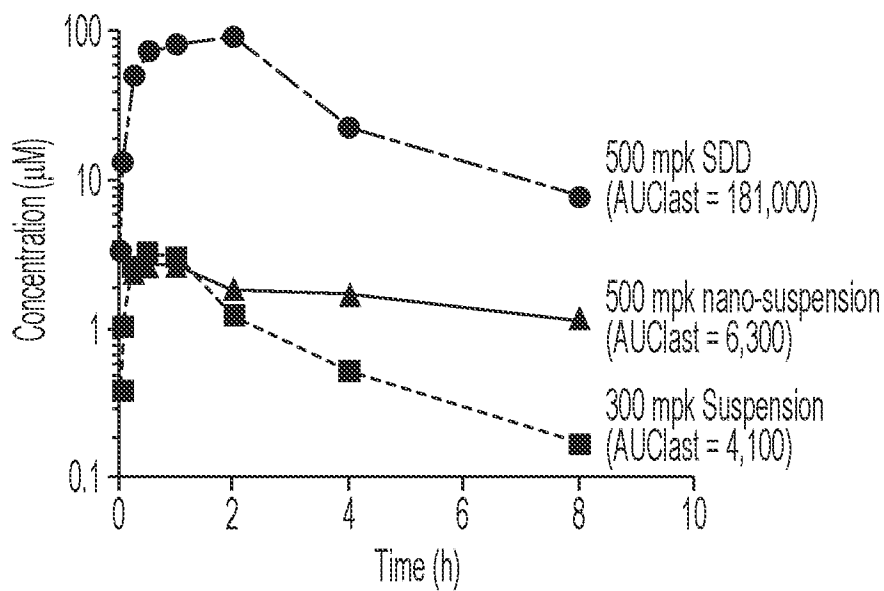


Figure 32

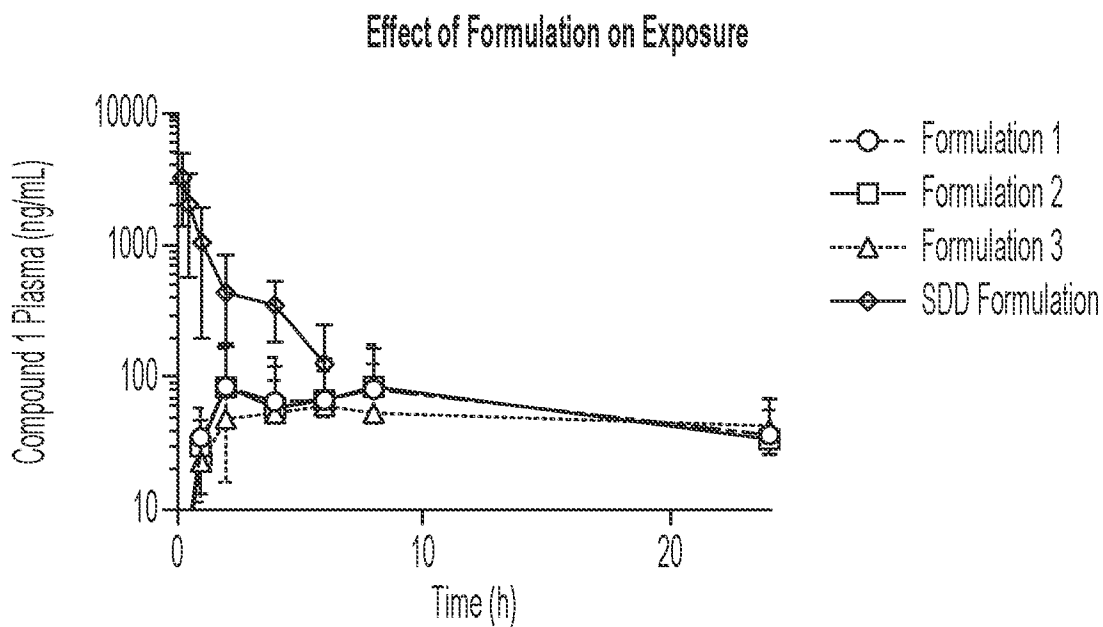


Figure 33

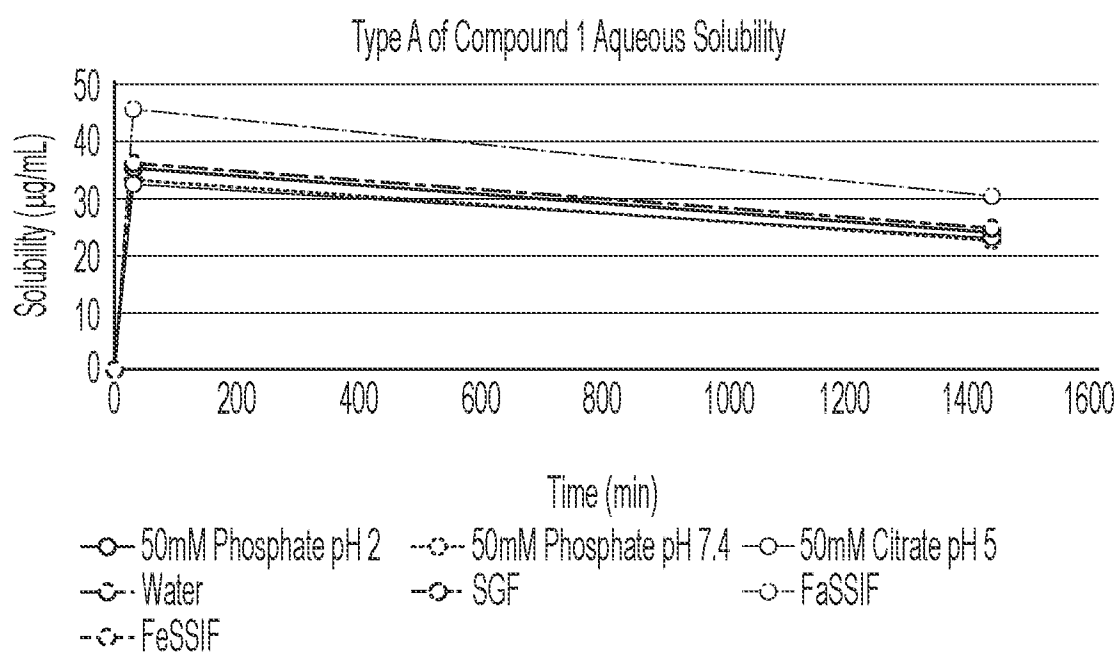


Figure 34

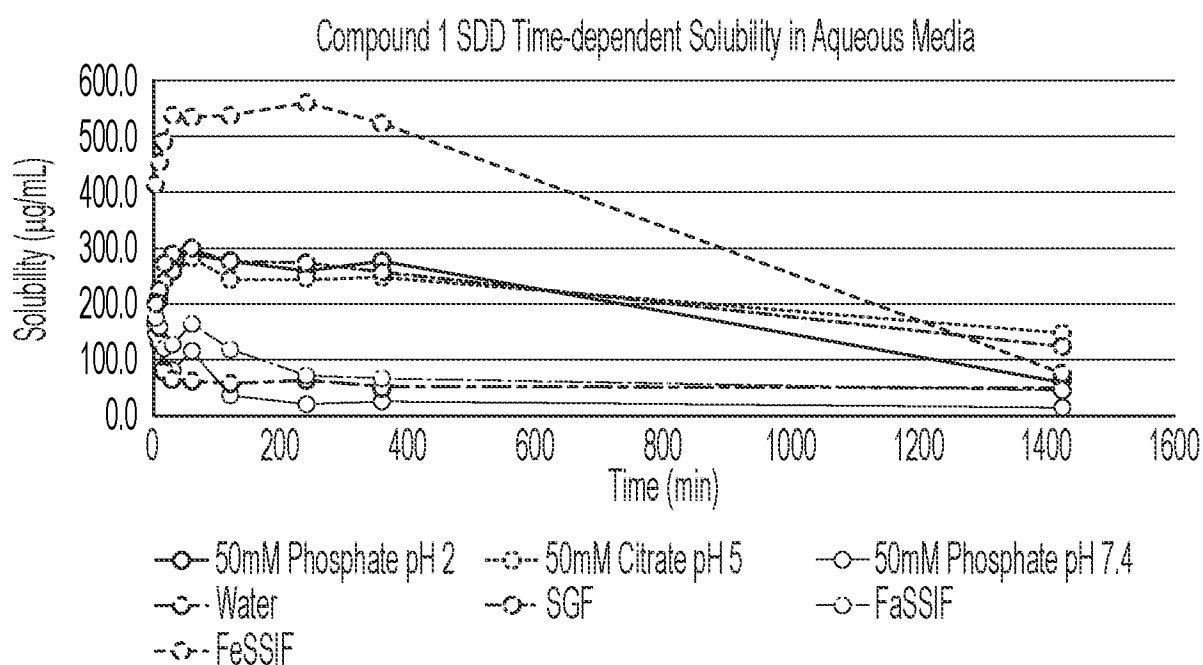


Figure 35

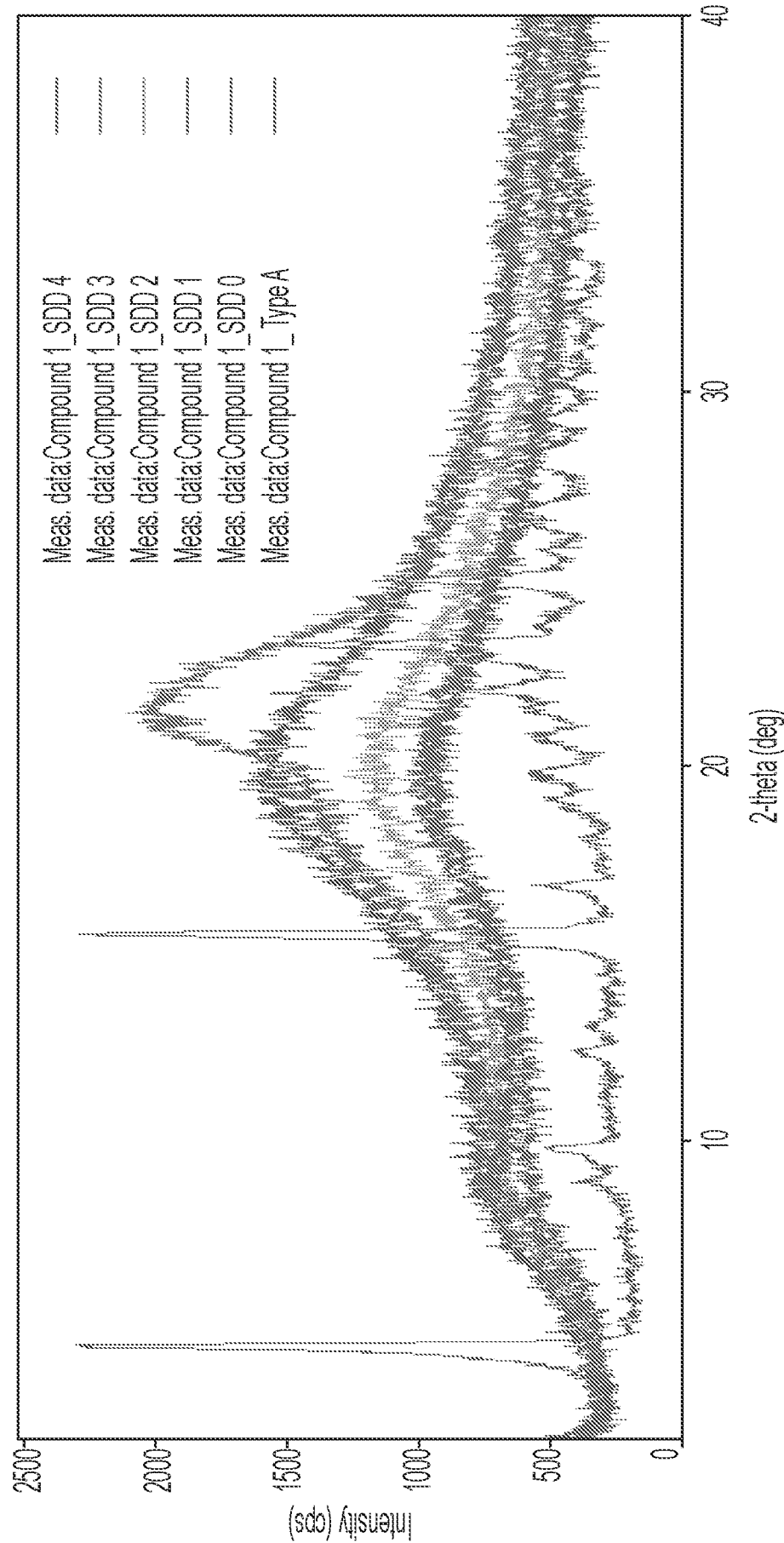


Figure 36

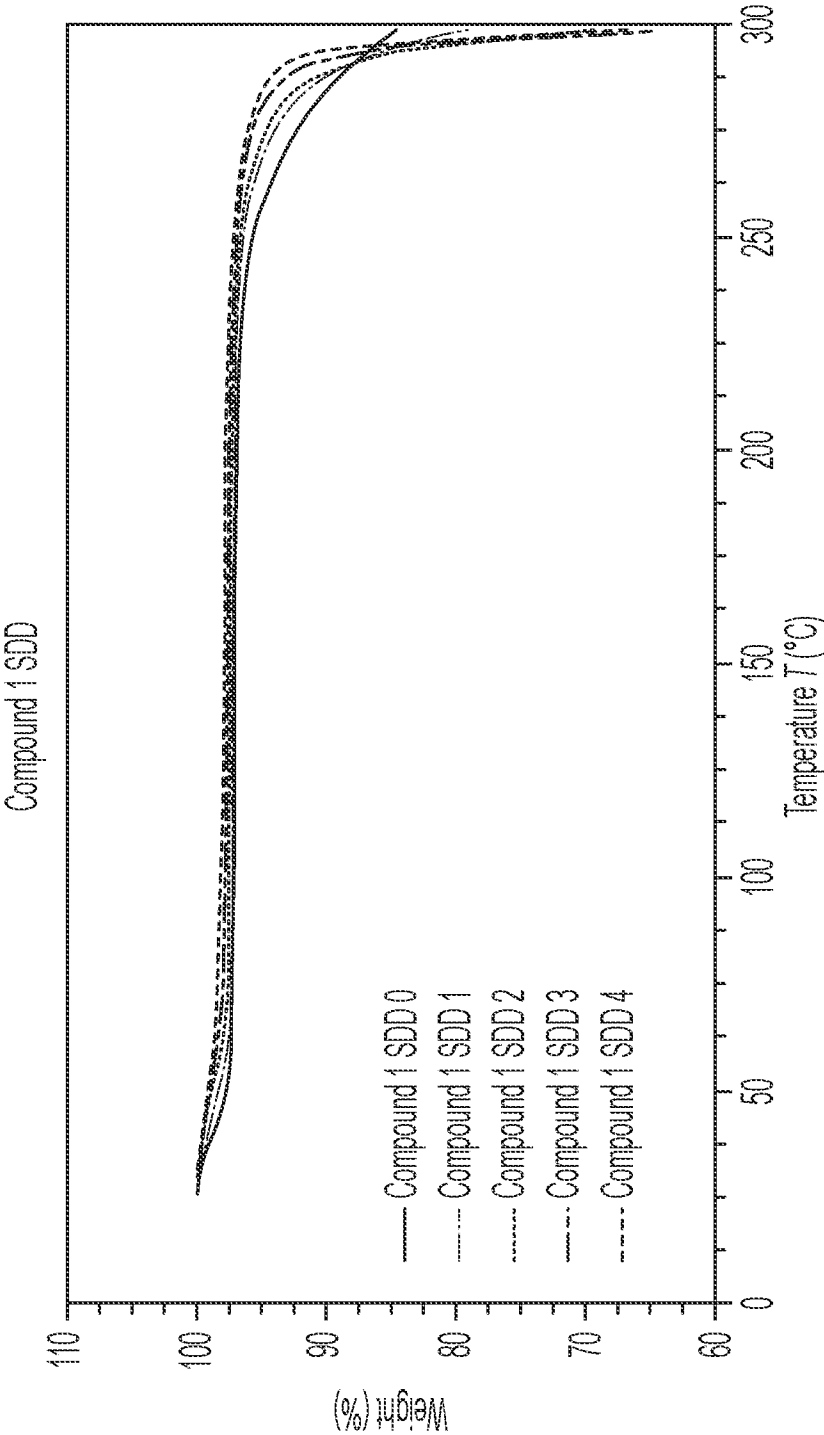


Figure 37

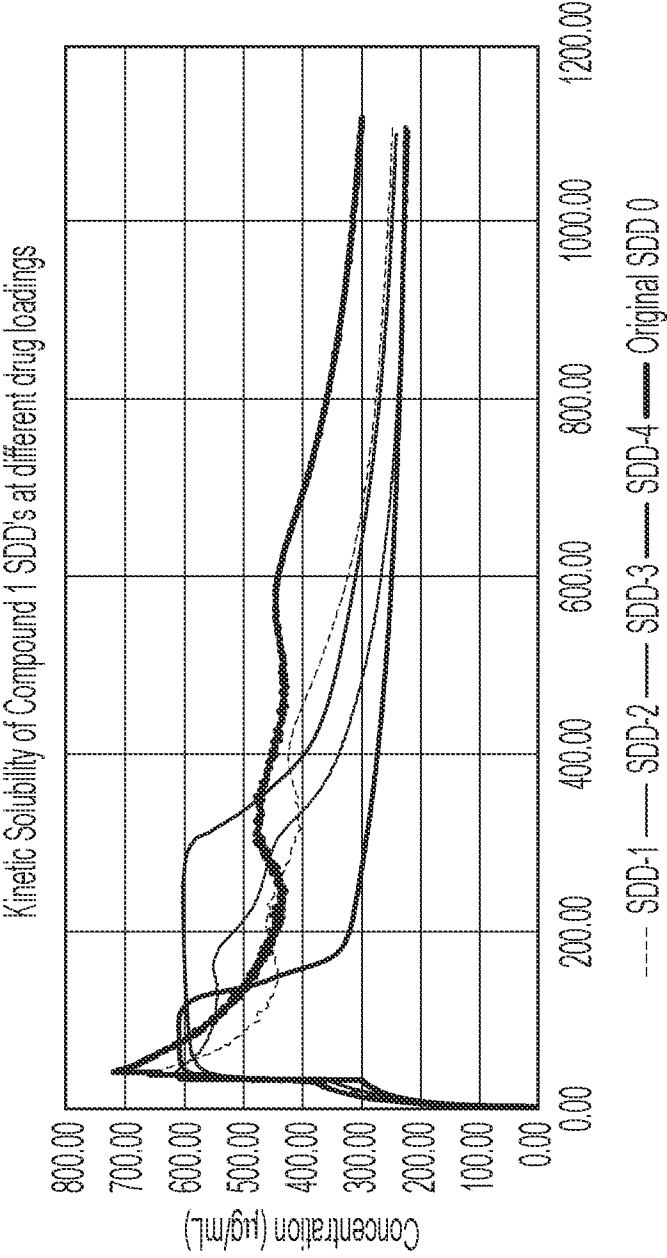


Figure 38

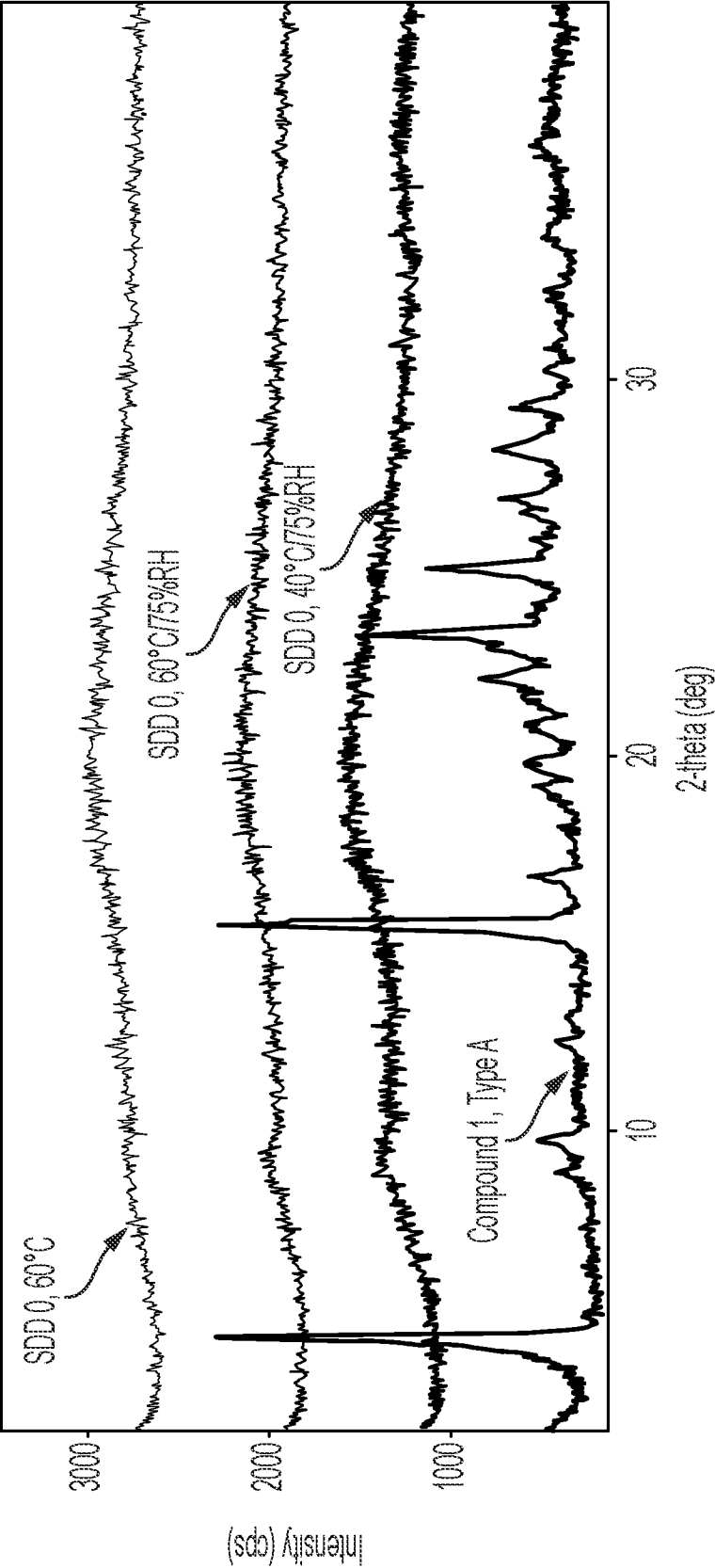


Figure 39

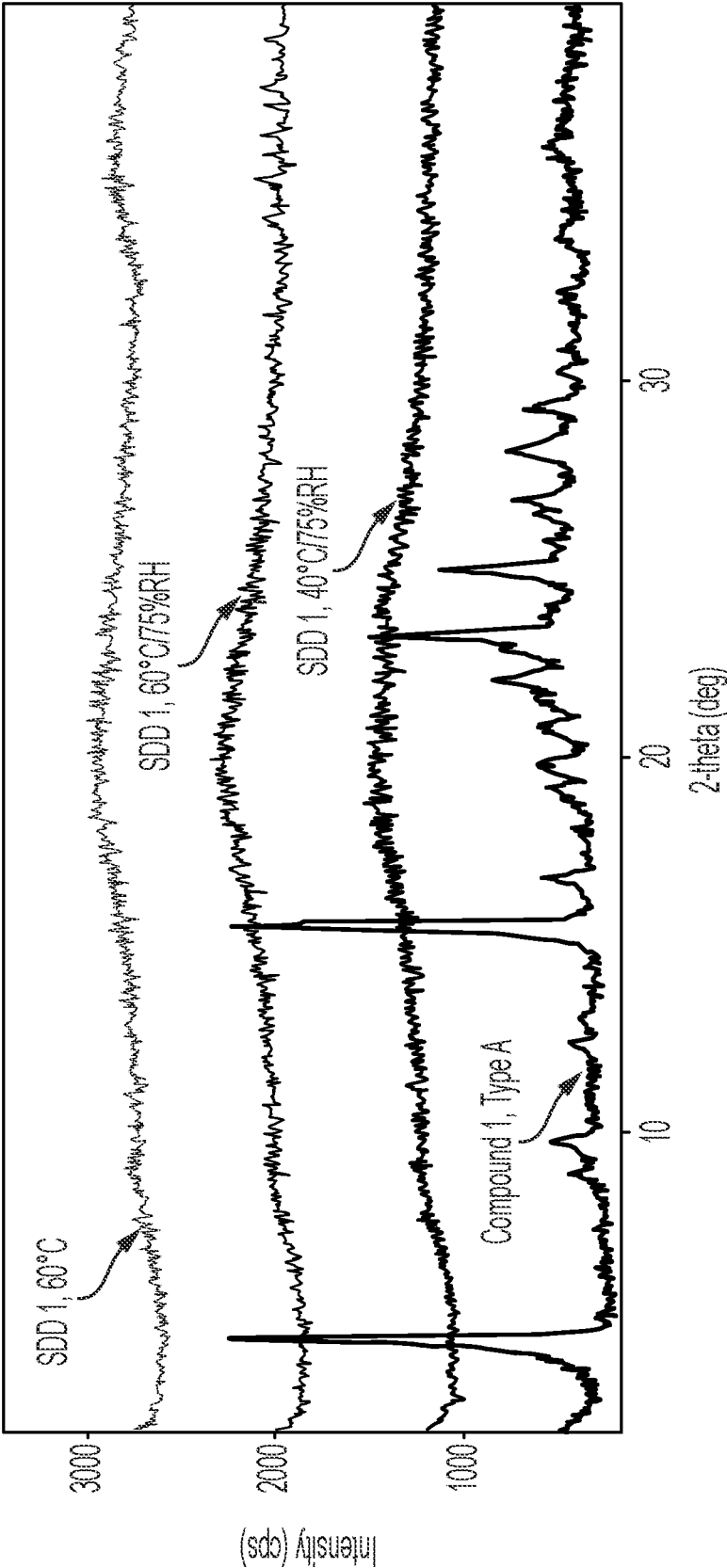


Figure 40

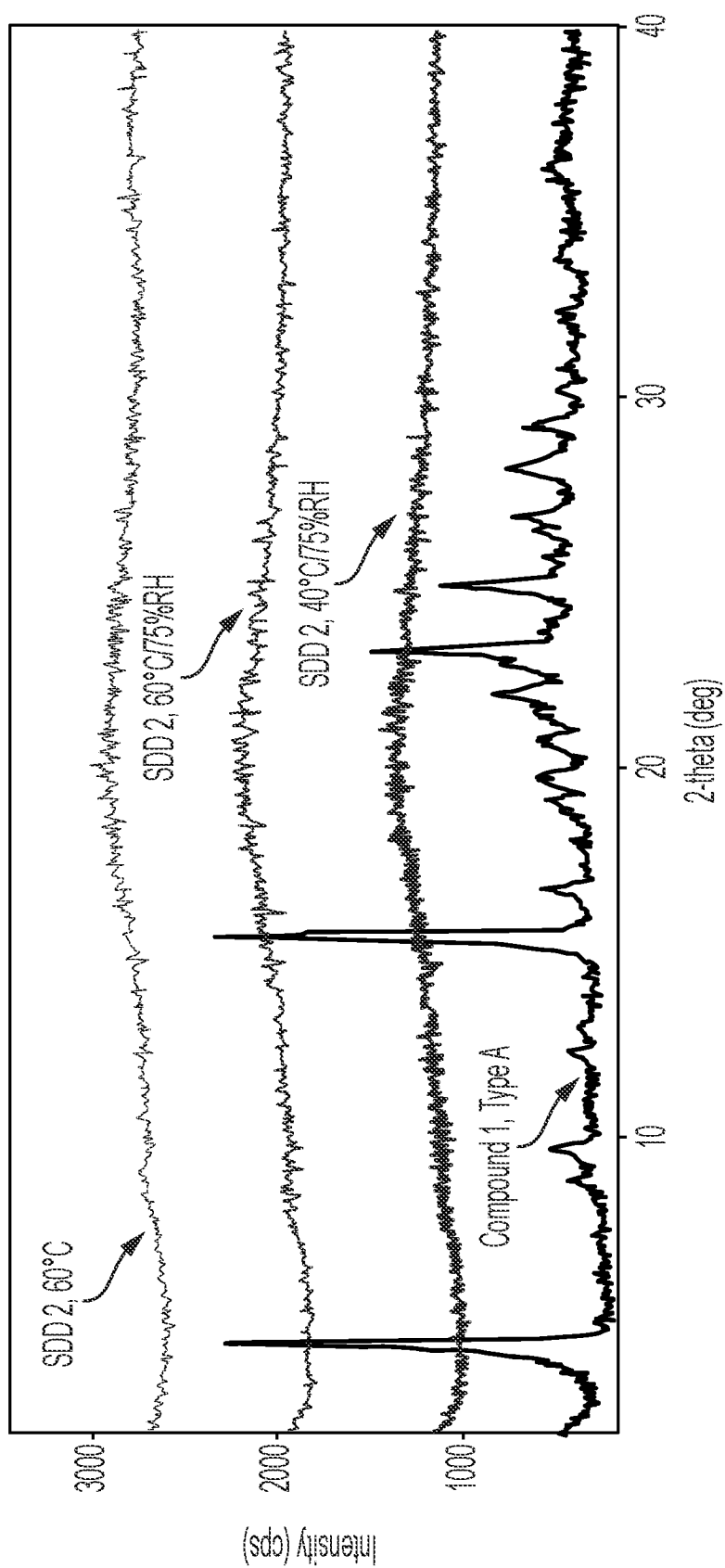


Figure 41

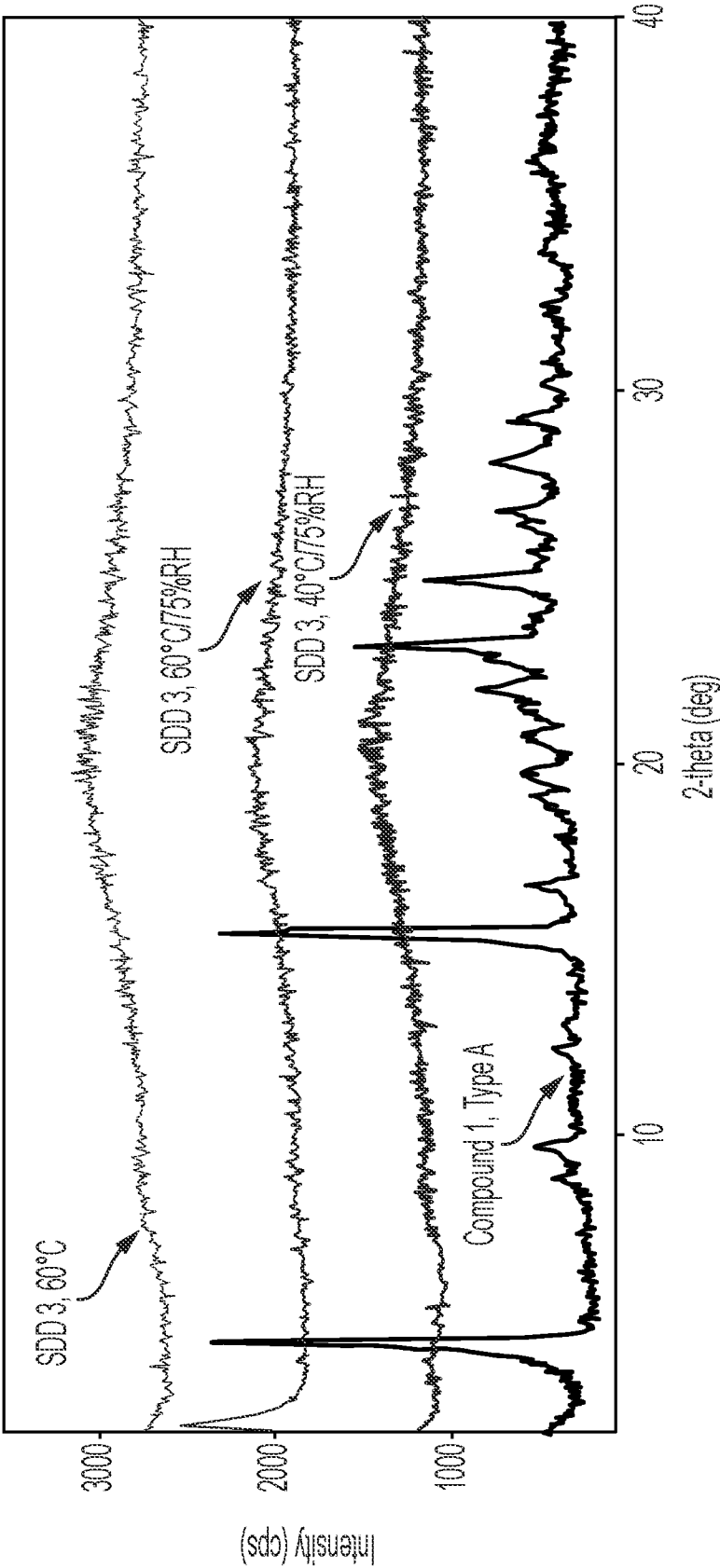


Figure 42

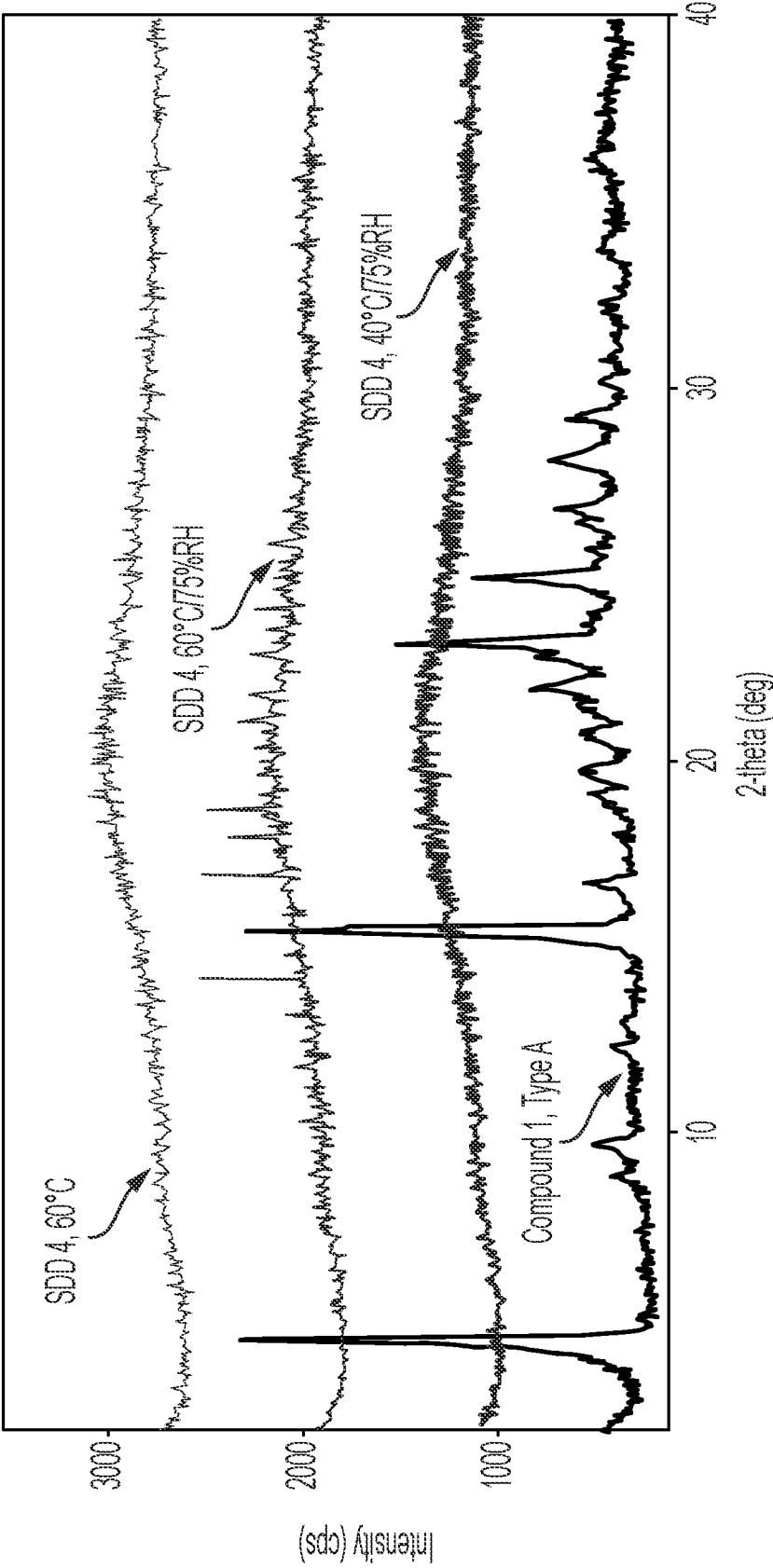


Figure 43

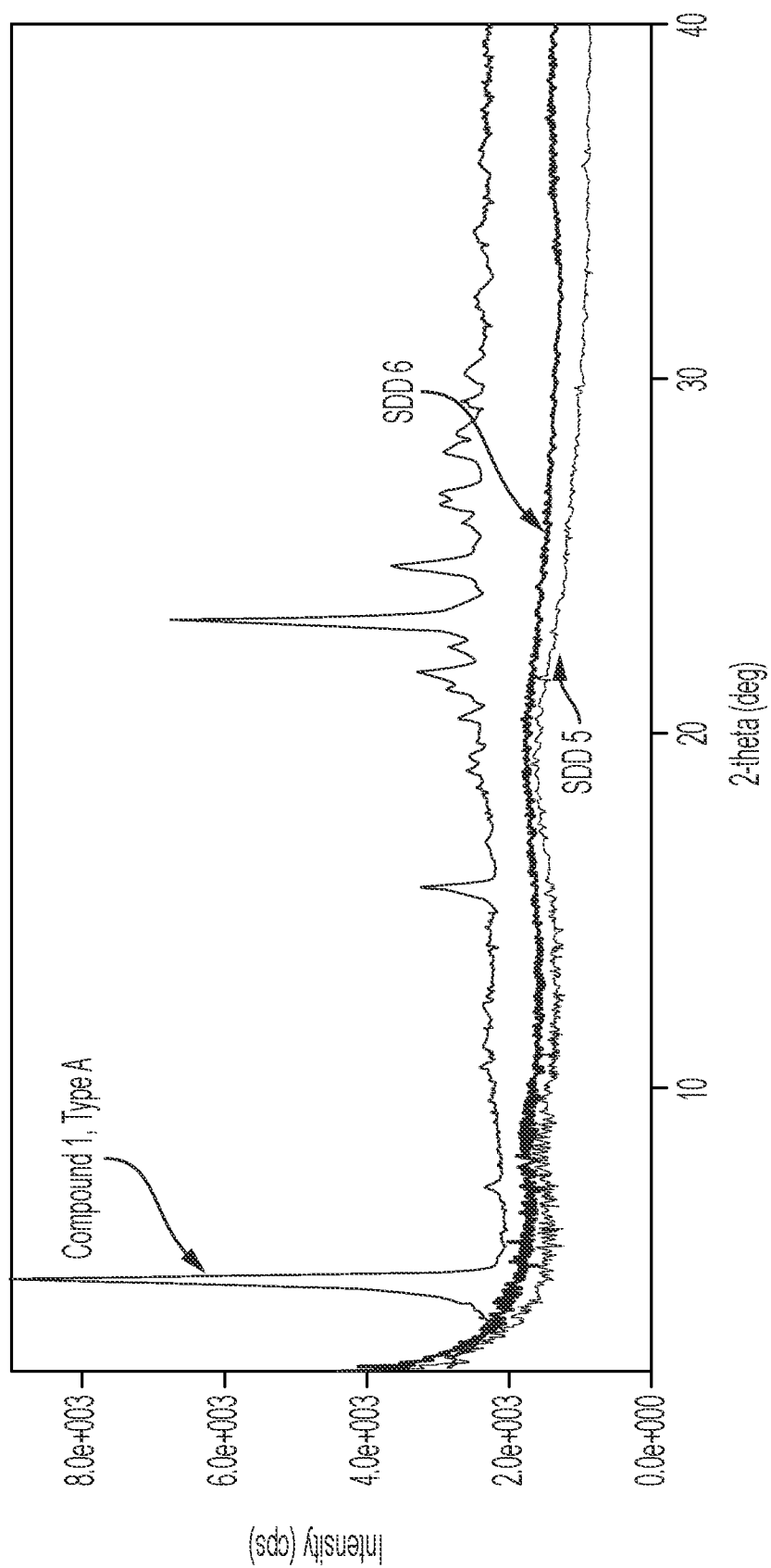


Figure 44

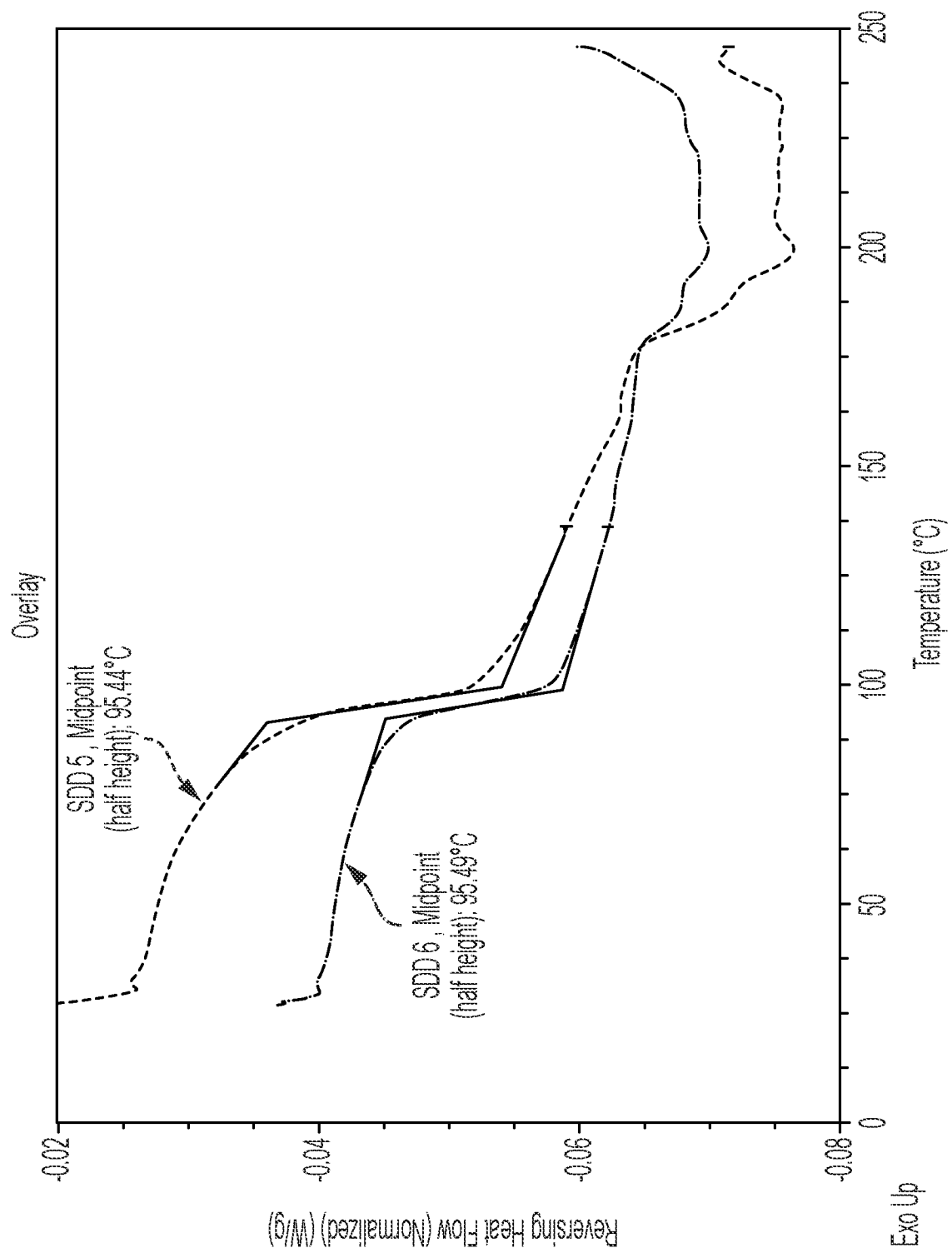


Figure 45

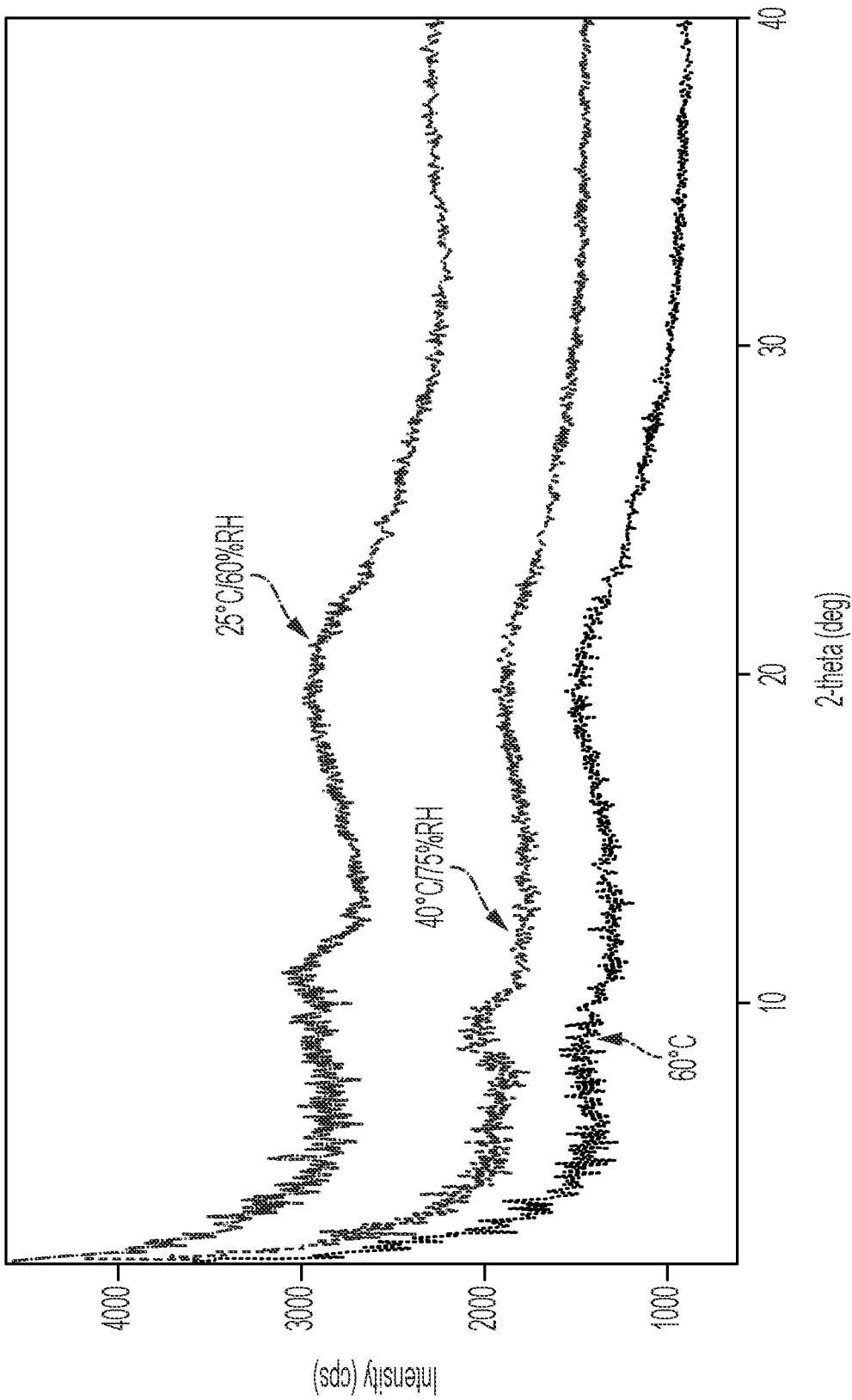


Figure 46

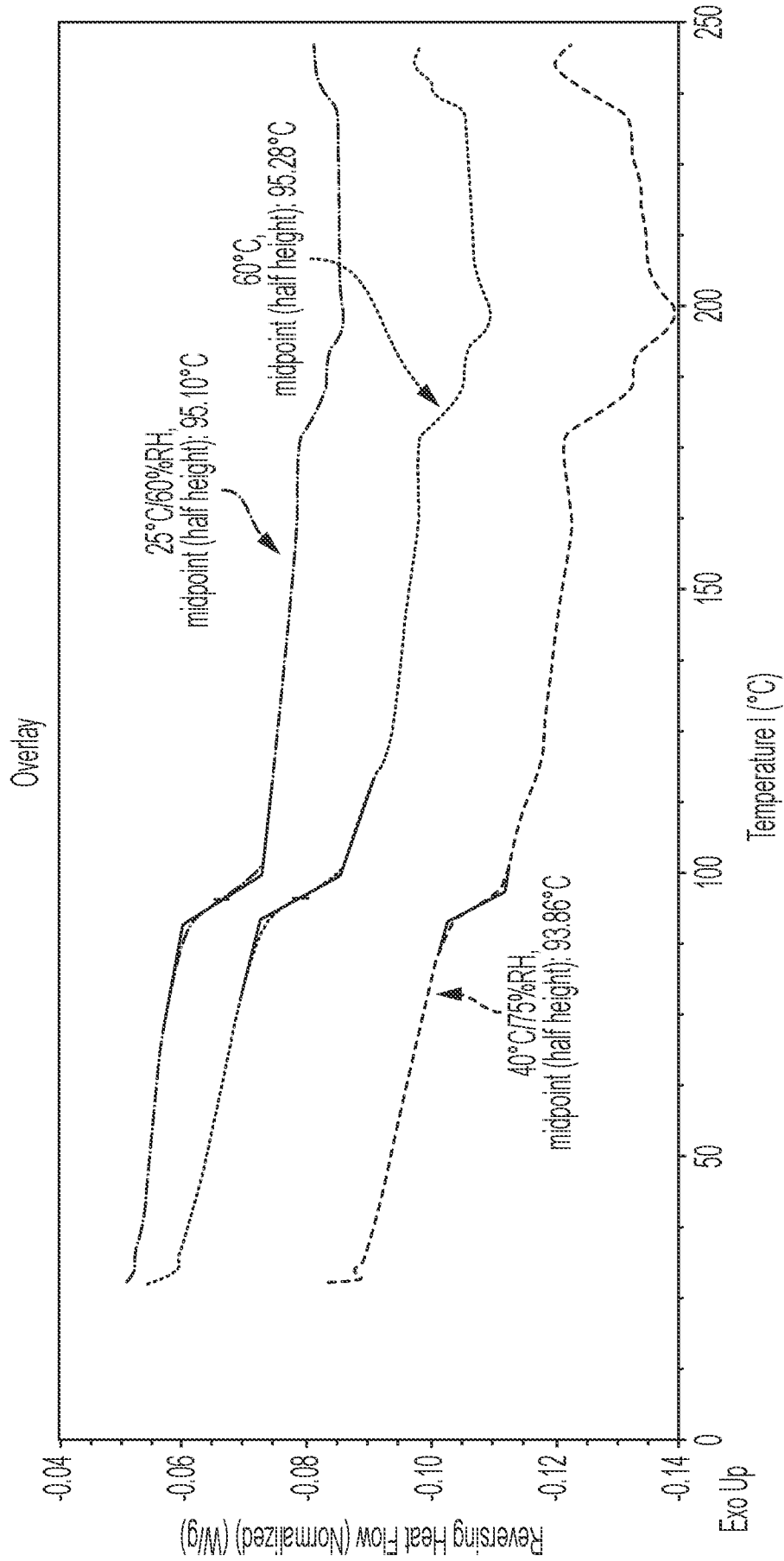


Figure 47

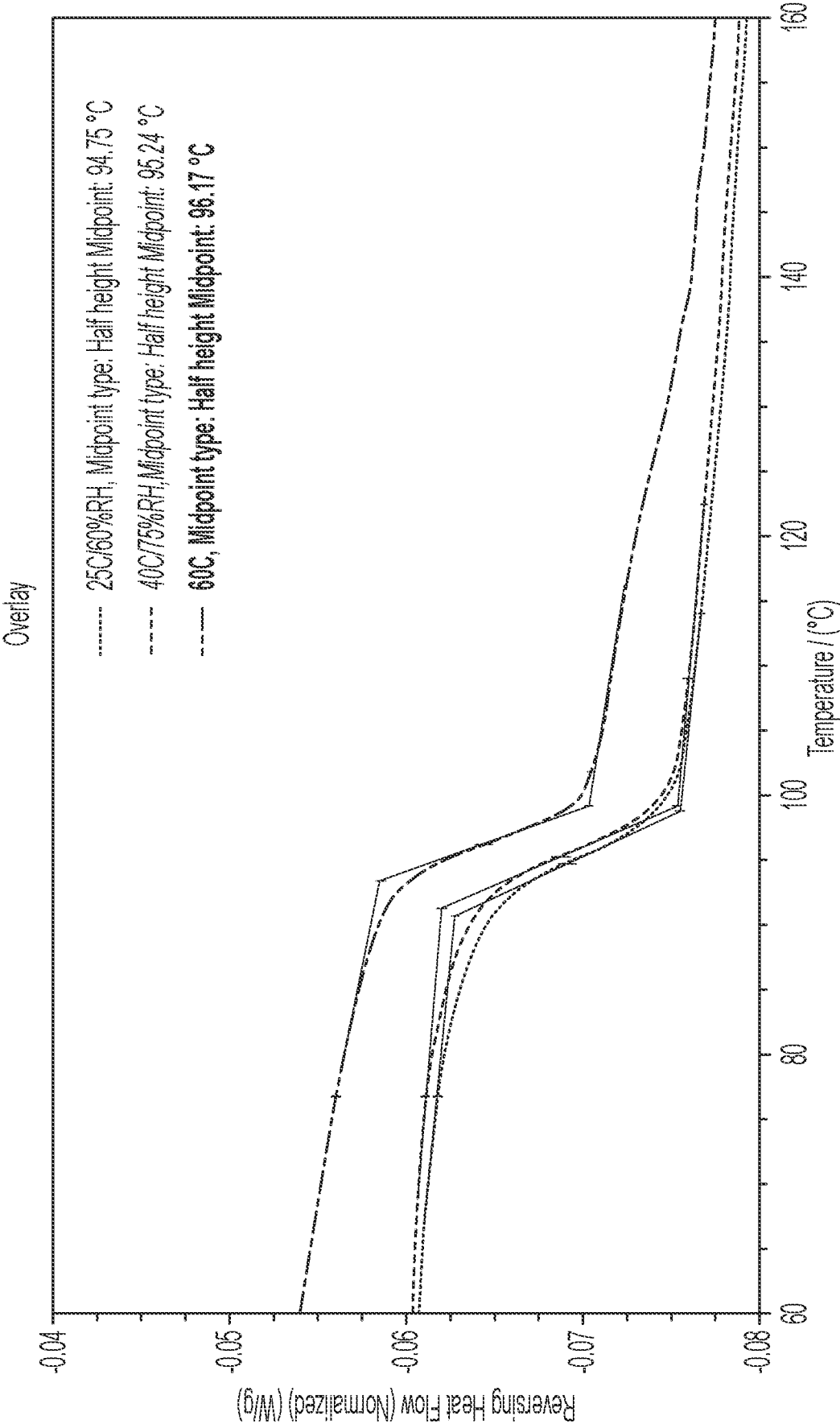


Figure 48

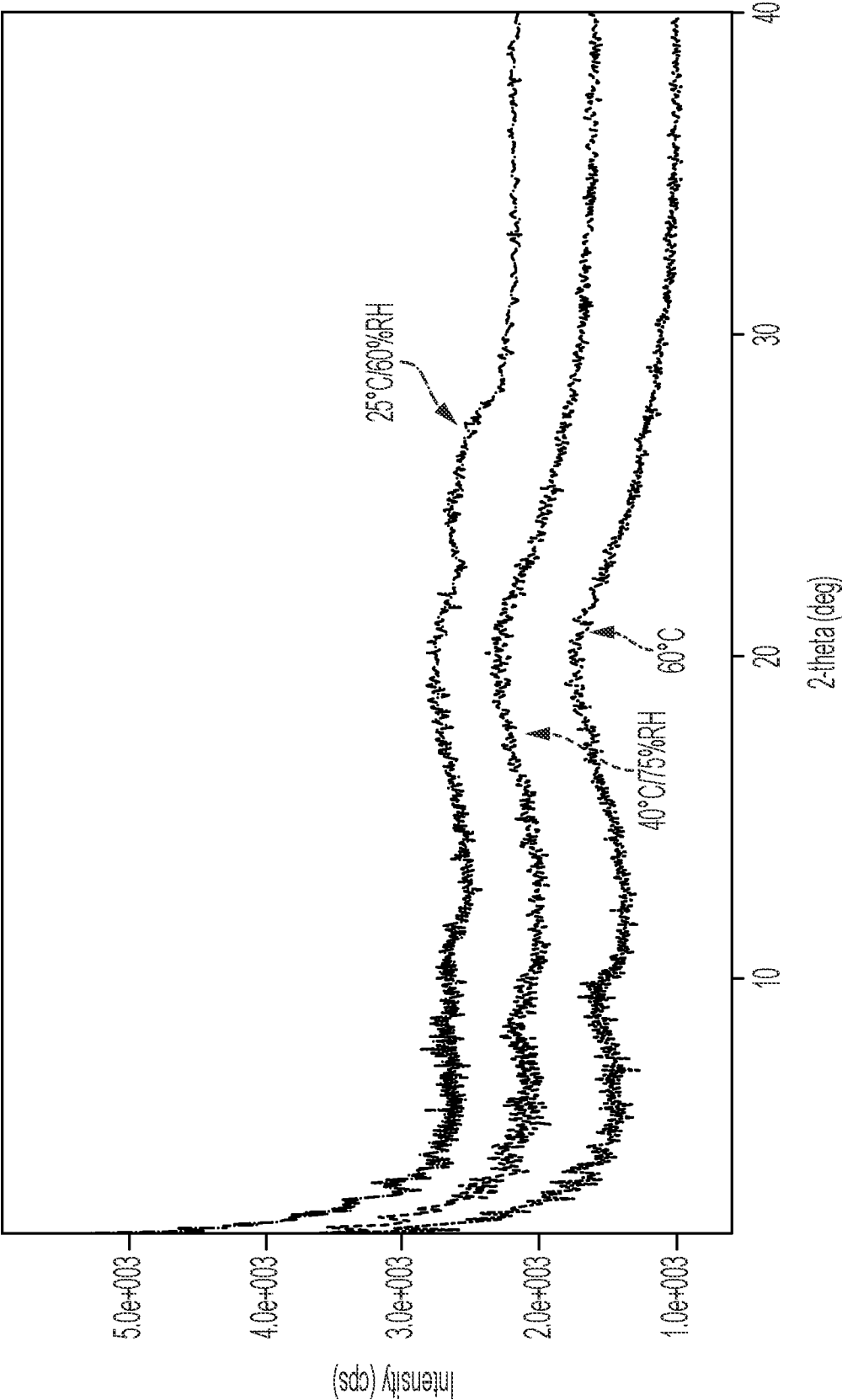


Figure 49

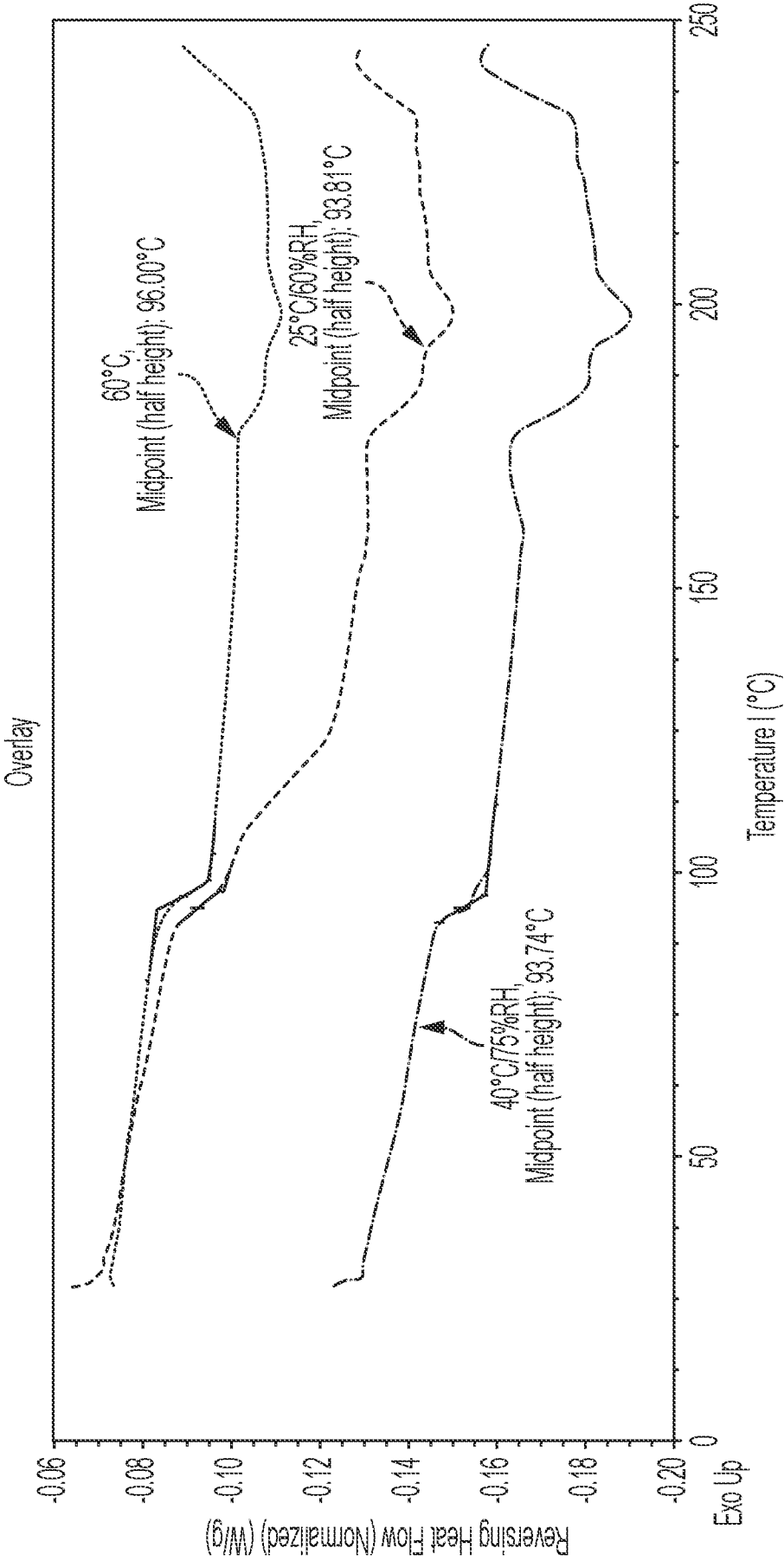


Figure 50

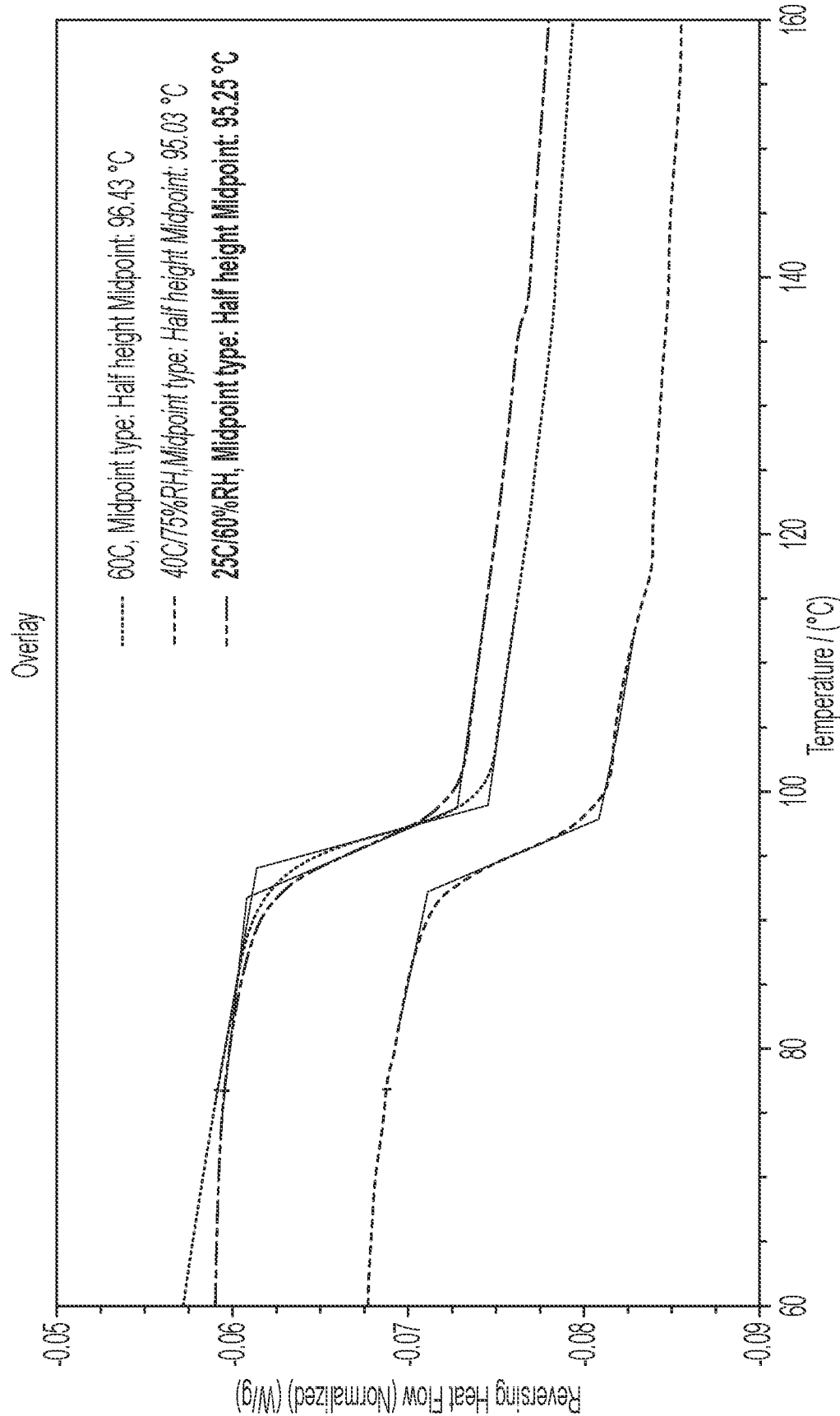


Figure 51

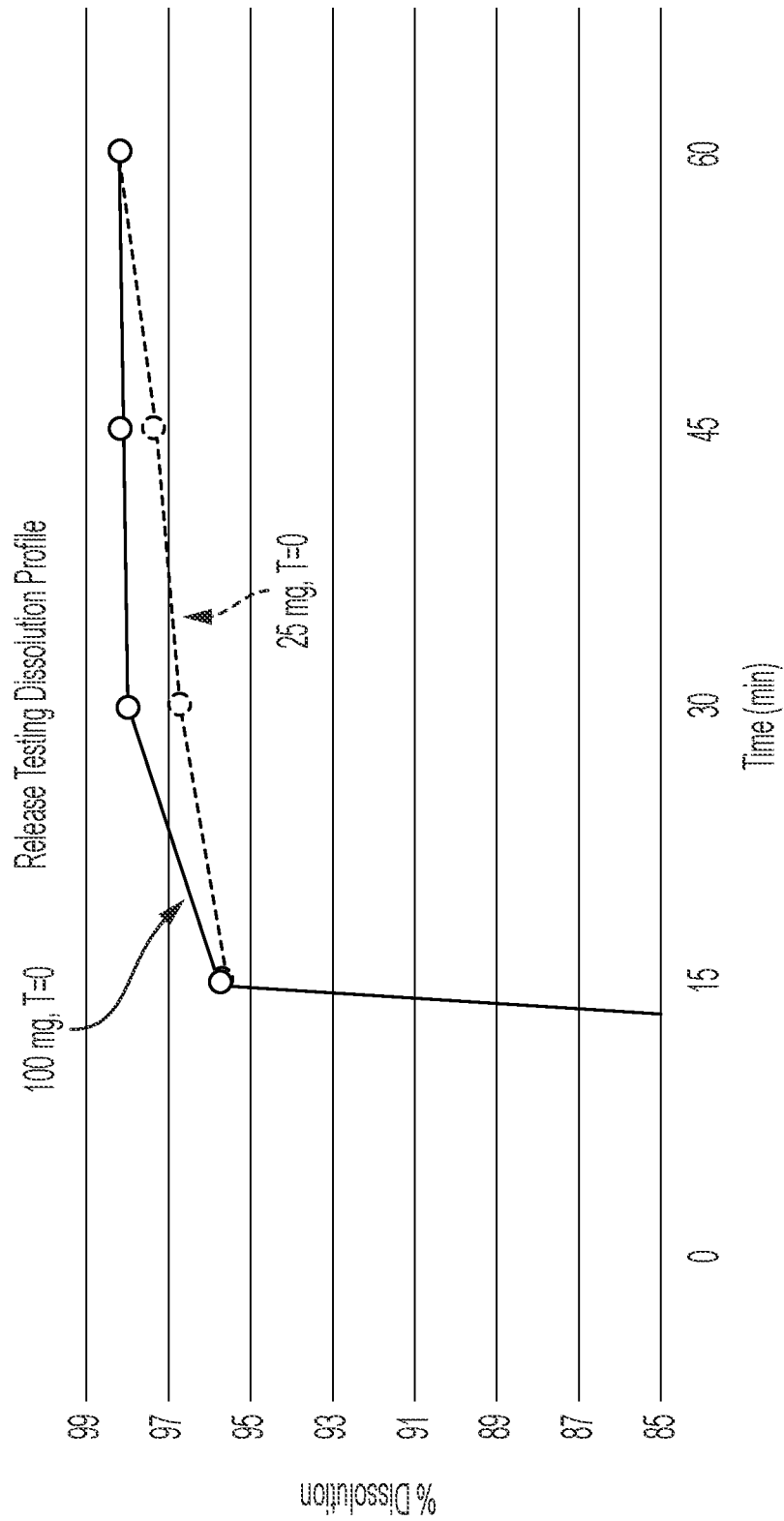


Figure 52

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2020/051645

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61K 31/407; A61K 31/436; A61P 7/06; C07D 487/04 (2020.01)

CPC - A61K 31/407; A61K 31/436; A61P 7/06; C07D 487/04 (2020.08)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

see Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

see Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

see Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2018/175474 A1 (FORMA THERAPEUTICS INC) 27 September 2018 (27.09.2018) entire document	11
A	WO 2016/046837 A1 (CADILA HEALTHCARE LIMITED) 31 March 2016 (31.03.2016) entire document	1-3, 11-15
A	PUBCHEM. CID 135338361. 15 December 2018, Pgs. 1-8. Retrieved from the Internet <URL: https://pubchem.ncbi.nlm.nih.gov/compound/135338361 >; page 2, formula	1-3, 11-15
A	US 2016/0106728 A1 (ACADEMIA SINICA) 21 April 2016 (21.04.2016) entire document	1-3, 11-15
A	US 2019/0218221 A1 (FORMA THERAPEUTICS INC) 18 July 2019 (18.07.2019) entire document	1-3, 11-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

10 November 2020

Date of mailing of the international search report

07 DEC 2020

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450

Facsimile No. 571-273-8300

Authorized officer

Blaine R. Copenheaver

Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2020/051645

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 4-10
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.