

(19) **DANMARK**



Patent- og
Varemærkestyrelsen

(10) **DK/EP 3191475 T3**

(12) Oversættelse af
europæisk patentskrift

-
- (51) Int.Cl.: **C 07 D 405/12 (2006.01)** **A 61 K 31/517 (2006.01)** **A 61 P 19/02 (2006.01)**
A 61 P 27/02 (2006.01) **A 61 P 29/00 (2006.01)** **A 61 P 35/00 (2006.01)**
A 61 P 35/02 (2006.01)
- (45) Oversættelsen bekendtgjort den: **2020-09-28**
- (80) Dato for Den Europæiske Patentmyndigheds
bekendtgørelse om meddelelse af patentet: **2020-07-29**
- (86) Europæisk ansøgning nr.: **15839519.4**
- (86) Europæisk indleveringsdag: **2015-09-07**
- (87) Den europæiske ansøgnings publiceringsdag: **2017-07-19**
- (86) International ansøgning nr.: **CN2015089035**
- (87) Internationalt publikationsnr.: **WO2016037550**
- (30) Prioritet: **2014-09-10 CN 201410456350**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV
MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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9FG, Storbritannien**
- (54) Benævnelse: **KRYSTALFORMER AF 6-((6,7-DIMETHOXYQUINAZOLIN-4-YL)OXY)-N,2-DIMETHYLBENZOFURAN-
3-CARBOXAMID**
- (56) Fremdragne publikationer:
WO-A2-2009/137797
CN-A- 101 575 333

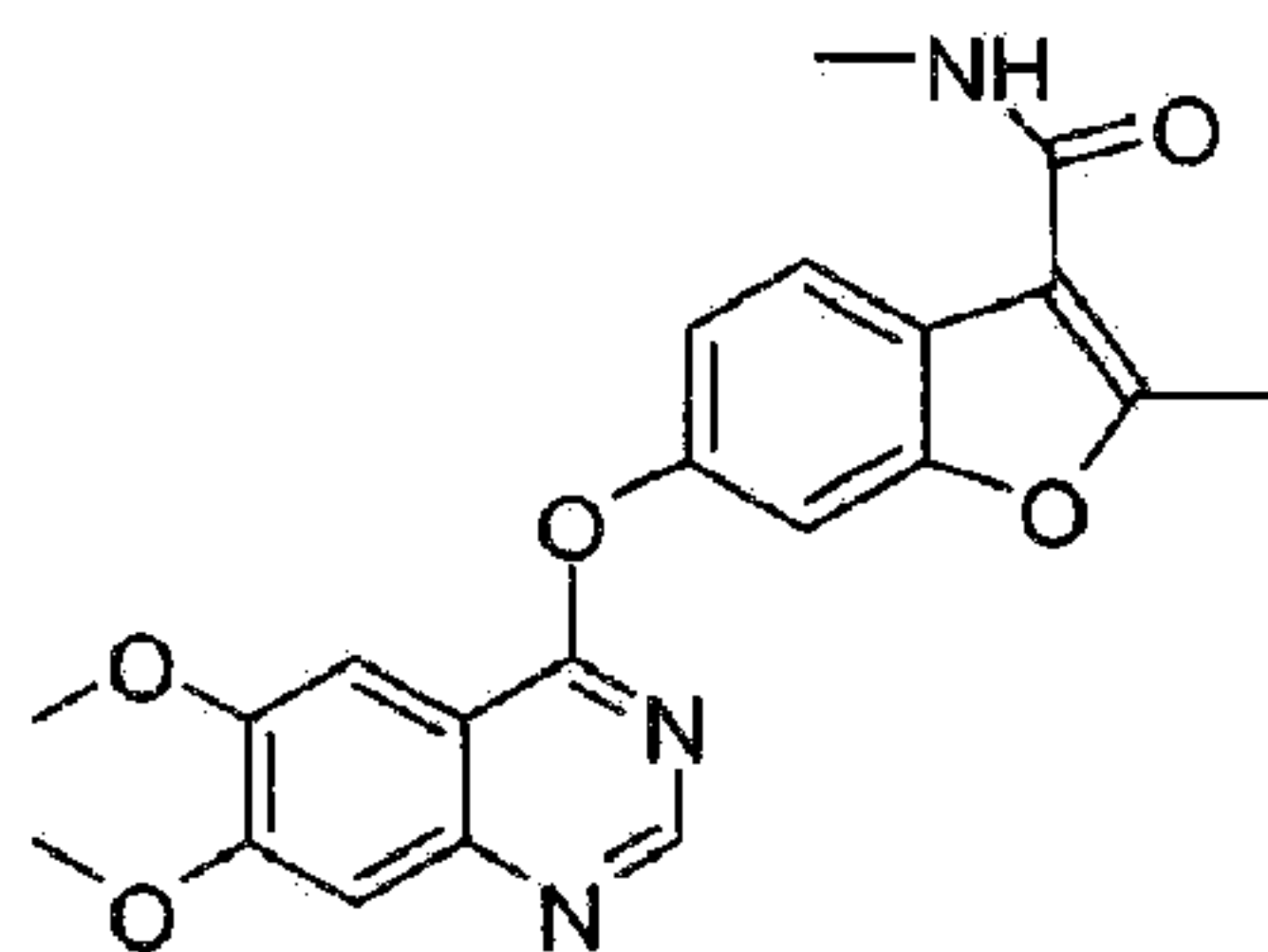
DESCRIPTION

Field of the Invention

[0001] The present invention relates to the pharmaceutical field, and provides a novel crystalline form of the compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, a pharmaceutical composition comprising the novel crystalline form, as well as methods of preparation and uses thereof, as further defined in the claims.

Background of the Invention

[0002] The compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide described herein, with the chemical structure of Formula A, shows KDR kinase inhibition activities. Vascular endothelial growth factor (VEGF), and its receptor VEGFR-2, also known as kinase insert domain-containing receptor (KDR), constitute an important angiogenic pathway. Studies have shown that inhibition of KDR can cause apoptosis of endothelial cells, which consequently block the angiogenesis process (Rubin M. Tuder, Chest, 2000; 117: 281). Thus, KDR inhibitors can be used for treating angiogenesis-related disorders, such as cancer, age-related macular degeneration and chronic inflammatory disease. Studies have shown that the compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide can be used for treating angiogenesis-related disorders, such as the treatment of cancer.



Formula A

[0003] The ability of a compound to exist in at least one crystal structure or solid state form is known as polymorphism. Many compounds may exist as polymorph crystals and those compounds may also exist in a solid amorphous state. Until polymorphism of a compound is discovered, it is highly unpredictable (1) whether a particular compound will exhibit polymorphism, (2) how to make any such unknown polymorphs, and (3) what the properties, such as stability, will be of any such unknown polymorphs. See, e.g., J. Bernstein "Polymorphism in Molecular Crystals", Oxford University Press, (2002).

[0004] Because the properties of any solid material depend on the structure as well as on the nature of the compound itself, different solid state forms of a compound can and often do

exhibit different physical and chemical properties. Differences in chemical properties can be determined through a variety of analytical techniques to be used to characterize, analyze, and compare. And those differences in chemical properties may ultimately be used to differentiate among different solid state forms that may be discovered to exist. Furthermore, differences in physical properties, such as solubility and bioavailability, of solid state forms can be important when formulating a pharmaceutical compound. As such, novel crystalline and amorphous solid state forms of pharmaceutical compounds, such as the compound of Formula A, can be important in the development of such compounds.

[0005] The compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide was described in WO 2009/137797 A2 and CN 101575333 A, and the methods of preparation thereof were also described therein.

Summary of the Invention

[0006] After a lot of exploration and research, we have found that the compound of Formula A(6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide) can exist in different crystalline forms, and can form solvates with certain solvents. The existence of various polymorphic forms of the compound of Formula A is explored in order to determine and prepare the most appropriate form of the compound for the pharmaceutical use. Based on these studies, the present invention provides the compound of Formula A in a new crystalline form, which is designated Form I. Also disclosed herein is the compound of Formula A in further crystalline forms, solvates and the crystalline forms thereof, which are designated Form II, Form III, Form IV, Form VII, and Form VIII, respectively.

In one aspect, the novel crystalline forms of the compound of Formula A or the solvates thereof, which are provided or disclosed herein, are crystalline, non-hygroscopic and stable.

[0007] In particular, the present invention provides Form I of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, i.e. Form I of the compound of Formula A, wherein the X-ray powder diffractogram of the Form I comprises diffraction angles expressed in degrees 2-theta (2θ) at: 5.3, 10.7, 13.9, and 14.6, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0008] Also disclosed herein are solvates of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, which are ethanol solvate, acetic acid solvate and dioxane solvate of the compound of Formula A.

[0009] Further, disclosed herein are solvates of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, which are hemiethanol solvate, monoacetic acid solvate and monodioxane solvate of the compound of Formula A.

[0010] Even further, disclosed herein is hemiethanol solvate of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, which is Form II of the compound of Formula

A.

[0011] Even further, disclosed herein is Form III of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, i.e. Form III of the compound of Formula A.

[0012] Even further, disclosed herein is monoacetic acid solvate of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, which is Form IV of the compound of Formula A.

[0013] Even further, disclosed herein is Form VII of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, i.e. Form VII of the compound of Formula A. Even further, disclosed herein is monodioxane solvate of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, which is Form VIII of the compound of Formula A.

[0014] In another aspect, the present invention provides methods of preparation of Form I of the compound of Formula A, which are reproducible and easy in operation. Also disclosed herein are methods of preparation of Form II, Form III, Form IV, Form VII and Form VIII.

[0015] In still another aspect, the present invention provides pharmaceutical compositions comprising an effective amount of Form I of the compound of Formula A, as described above, and at least one pharmaceutically acceptable carrier.

[0016] The present invention further relates to Form I of the compound of Formula A for use in treating diseases associated with KDR inhibition, for example angiogenesis-related disorders, such as cancer, age-related macular degeneration and chronic inflammatory disease, in a subject in recognized need thereof.

[0017] In particular, the invention relates to Form I for use in treating angiogenesis-related disorders. In some embodiments, said angiogenesis-related disorders are selected from cancer, age-related macular degeneration and chronic inflammatory disease.

Brief Description of the Drawings

[0018]

Figure 1 shows a powder X-ray diffractogram of Form I of the compound of Formula A, the horizontal axis (x-axis) plots the diffraction 2 theta, and the vertical axis (y-axis) plots the intensity (counts).

Figure 2 shows a differential scanning calorimeter (DSC) thermogram of Form I of the compound of Formula A, the horizontal axis (x-axis) plots the temperature (°C), and the vertical axis (y-axis) plots the heat flow (mW).

Figure 3 shows a Thermogravimetric (TG) curve of Form I of the compound of Formula A, the

horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the weight percentage (%).

Figure 4 shows a powder X-ray diffractogram of Form II of hemiethanol solvate of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the diffraction 2 theta, and the vertical axis (y-axis) plots the intensity (counts).

Figure 5 shows a differential scanning calorimeter (DSC) thermogram of Form II of hemiethanol solvate of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the heat flow (mW).

Figure 6 shows a Thermogravimetric (TG) curve of Form II of hemiethanol solvate of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the weight percentage (%).

Figure 7 shows a powder X-ray diffractogram of Form III of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the diffraction 2 theta, and the vertical axis (y-axis) plots the intensity (counts).

Figure 8 shows a differential scanning calorimeter (DSC) thermogram of Form III of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the heat flow (mW).

Figure 9 shows a Thermogravimetric (TG) curve of Form III of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the weight percentage (%).

Figure 10 shows a powder X-ray diffractogram of Form IV of monoacetic acid solvate of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the diffraction 2 theta, and the vertical axis (y-axis) plots the intensity (counts).

Figure 11 shows a differential scanning calorimeter (DSC) thermogram of Form IV of monoacetic acid solvate of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the heat flow (mW).

Figure 12 shows a Thermogravimetric (TG) curve of Form IV of monoacetic acid solvate of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the weight percentage (%).

Figure 13 shows a powder X-ray diffractogram of Form VII of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the diffraction 2 theta, and the vertical axis (y-axis) plots the intensity (counts).

Figure 14 shows a differential scanning calorimeter (DSC) thermogram of Form VII of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the heat flow (mW).

Figure 15 shows a Thermogravimetric (TG) curve of Form VII of the compound of Formula A

(as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the weight percentage (%).

Figure 16 shows a powder X-ray diffractogram of Form VIII of monodioxane solvate of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the diffraction 2 theta, and the vertical axis (y-axis) plots the intensity (counts).

Figure 17 shows a differential scanning calorimeter (DSC) thermogram of Form VIII of monodioxane solvate of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the heat flow (mW).

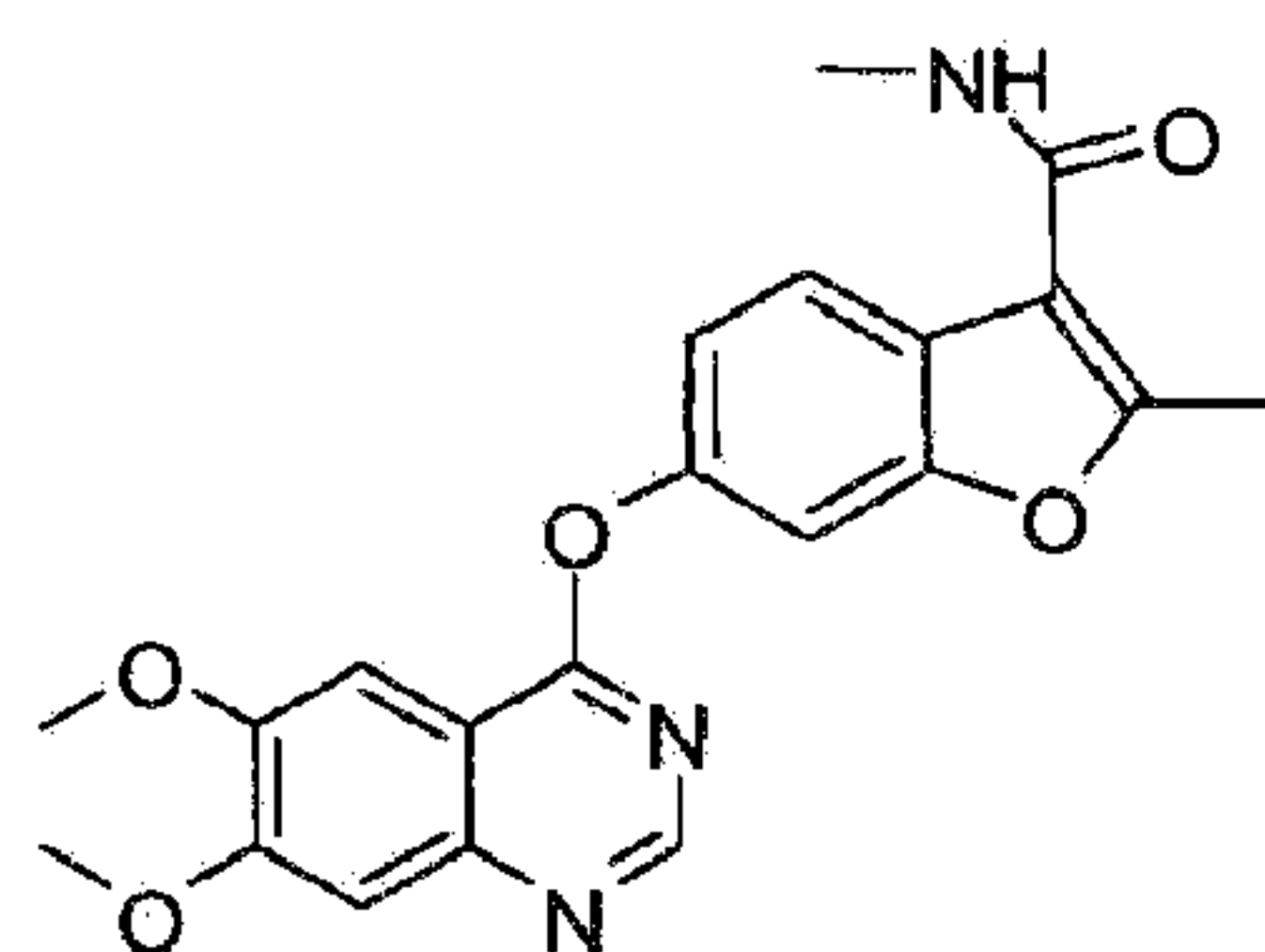
Figure 18 shows a Thermogravimetric (TG) curve of Form VIII of monodioxane solvate of the compound of Formula A (as disclosed herein), the horizontal axis (x-axis) plots the temperature ($^{\circ}\text{C}$), and the vertical axis (y-axis) plots the weight percentage (%).

Definitions

[0019] Unless indicated otherwise, as used in the present patent (including the specification and the claims), the following abbreviations or terms have the meanings as set forth below.

[0020] The term "crystalline form of the present invention" as used herein refers to the crystalline form Form I of the compound of Formula A. As explained above, also disclosed herein are the crystalline forms Form II, Form III, Form IV, Form VII or Form VIII of the compound of Formula A, or the solvates thereof, as well as mixtures thereof. "Form", "crystalline form" and "polymorph," may be used interchangeably herein.

[0021] The term "compound of Formula A", or "6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide" as used herein, refers to a compound with the following chemical structure of Formula A (also referenced as "Compound A"):



Formula A

[0022] The term " C_{3-6} alkanol" as used herein refers to a fully saturated straight or branched alkyl alcohol, containing 3, 4, 5, or 6 carbon atoms. Examples include but are not limited to, n-propanol, i-propanol, n-butanol, i-butanol, t-butanol, n-pentanol, i-pentanol, n-hexanol, and the like.

[0023] The term "C₅₋₈ straight or branched alkane" as used herein refers to a fully saturated straight or branched hydrocarbon, containing 5, 6, 7, or 8 carbon atoms. Examples include but are not limited to, n-pentane, n-hexane, n-heptane, n-octane.

[0024] The term "organic acid ester with not more than eight carbon atoms" as used herein refers to R₁COOR₂, wherein R₁ and R₂ are independently saturated or unsaturated, straight or branched hydrocarbon radical containing 1, 2, 3, 4, 5, 6, or 7 carbon atoms (C₁₋₇ hydrocarbon radical), and the total number of the carbon atoms of R₁ and R₂ is not more than 7. Examples include but are not limited to, methyl acetate, ethyl acetate, propyl acetate.

[0025] The term "haloalkane with less than three carbon atoms" as used herein refers to a fully saturated hydrocarbon containing 1 or 2 carbon atoms, which is substituted with one or more halogen atoms selected from F, Cl, Br, or I. Examples include dichloromethane, trichloromethane, carbon tetrachloride, 1,2-dichloroethane, and the like.

[0026] The term "about" as used herein refers to the deviation from a given numerical value above or below the given value by a variance of no more than 10%.

[0027] The term "substantially free of other forms" as used herein refers to the content of said other forms is less than 40%, preferably less than 30%, preferably less than 20%, preferably less than 10%, preferably less than 5%, preferably less than 1%, by weight.

[0028] The term "solution" as used herein means an appropriate mixture for purposes disclosed herein of one or more solutes in one or more solvents. Solution is intended to encompass homogeneous mixtures as well as heterogeneous mixtures, such as slurries or other suspension mixtures having insoluble (not dissolved) material.

[0029] The term "organic solvent" as used herein is broadly intended to mean any appropriate organic solvent for purposes disclosed herein.

[0030] The term "dissolution solvent" as used herein refers to any organic solvent that is appropriate by being capable of dissolving, in whole or in part, the substrate under suitable conditions, such as an appropriate amount and an appropriate temperature, such as room temperature or an elevated temperature.

[0031] The term "anti-dissolution solvent" as used herein refers to any appropriate organic solvent in which the substrate has less solubility than in the dissolution solvent.

[0032] "Pharmaceutically acceptable salts" as used herein include, but are not limited to salts with inorganic acids, such as hydrochlorate, hydrobromate, phosphate, phosphite, sulfate, sulfite, nitrate, and like salts; as well as salts with an organic acid, such as malate, maleate, mandelate, fumarate, tartrate, succinate, citrate, aspartate, glutamate, 2-hydroxyl-2-phenylpropionate, gluconate, propionate, lactate, camphorsulfonate, methanesulfonate,

ethanesulfonate, naphthalenesulfonate, p-toluenesulfonate, 2-hydroxyethylsulfonate, β -hydroxybutyrate, benzoate, salicylate, stearate, and alkanoate such as acetate, $\text{HOOC}-(\text{CH}_2)_n-\text{COOH}$ wherein n is 0-4, and like salts. Similarly, pharmaceutically acceptable cations include, but are not limited to, sodium, potassium, calcium, aluminum, lithium, and ammonium.

[0033] In addition, if a compound described herein is obtained as an acid addition salt, the free base can be obtained by basifying a solution of the acid addition salt. Conversely, if the product is a free base, an addition salt described above may be produced by dissolving the free base in a suitable organic solvent and treating the solution with an acid, in accordance with conventional procedures for preparing acid addition salts from base compounds. Those skilled in the art will recognize various synthetic methodologies that may be used within the realm of routine experimentation to prepare non-toxic pharmaceutically acceptable addition salts.

[0034] The term "effective amount" of the compound of Formula A, including the crystalline form, solvates and the crystalline forms thereof described herein means an amount effective, when administered to a subject in recognized need, such as a human or non-human patient, to alleviate, improve the symptoms, or stop or delay the progression of at least one disease associated with KDR, such as angiogenesis-related disorders, for example cancer, age-related macular degeneration and chronic inflammatory disease. "Effective amount" may vary with various factors, such as compound, state of treated disease, severity of treated disease, age and health status of the individual, administration route and form, judgement of the attending physician or a veterinary practitioner, and so on.

[0035] The term "subject" as used herein means mammals and non-mammals. Mammals means any member of the mammalia class including, but not limited to, humans; non-human primates such as chimpanzees and other apes and monkey species; farm animals such as cattle, horses, sheep, goats, and swine; domestic animals such as rabbits, dogs, and cats; laboratory animals including rodents, such as rats, mice, and guinea pigs; and the like. Examples of non-mammals include, but are not limited to, birds, and the like. The term "subject" does not denote a particular age or sex.

DETAILED DESCRIPTION OF THE INVENTION

[0036] The present invention provides a novel crystalline form of the compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide, i.e. Form I, wherein the X-ray powder diffractogram of Form I comprises diffraction angles expressed in degrees 2-theta (2θ) at: 5.3, 10.7, 13.9, and 14.6, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0037] Disclosed herein are also further novel crystalline forms, solvates and the crystalline forms thereof of the compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide.

[0038] The novel crystalline forms that are provided or disclosed herein are crystalline, non-hygroscopic and stable.

[0039] As described herein, the novel crystalline forms may be identified by any one or more solid state analytical methods. For example, crystalline forms described herein may be characterized according to any one or more of, e.g., X-ray powder diffraction, lattice parameters obtained from a single crystal, Fourier Transform Infrared Spectroscopy, differential scanning calorimetry curve data, and/or a thermogravimetric curve. And if characterization by one of those methods is consistent with the existence of forms described herein, it does not mean that any one of the other methods is inconsistent with that existence.

[0040] As described herein, the novel crystalline forms may be characterized according to X-ray powder diffraction. However, it is known in the art that the intensity and/or measured peaks in the X-ray powder diffractogram of different batches of a crystalline form may vary, because of, for example, different experimental conditions and/or preferred orientations. And according to the instrument precision, the measurement error of 2θ value is at about ± 0.2 2θ . However, known is the value of the relative intensity of the peaks more dependent than peak position on certain properties of the measured samples, such as crystal size in the sample, orientation effect of crystalline and purity of the analysed materials, therefore, the deviation of the peak intensity at about $\pm 20\%$ or greater range may occur. But notwithstanding experimental and machine errors, and principles such as preferred orientation, one skilled in the art can find sufficient information in the XRPD data provided herein to identify Form I and any other crystalline forms disclosed herein.

Form I

[0041] Provided herein is Form I of the compound of Formula A.

[0042] The X-ray powder diffractogram of the Form I of the compound of Formula A has characteristic diffraction angles (2θ) of 5.3 degrees, 10.7 degrees, 13.9 degrees, 14.6 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0043] In some embodiments, the X-ray powder diffractogram of the Form I of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.3 degrees, 7.3 degrees, 10.7 degrees, 13.9 degrees, 14.6 degrees, 19.9 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0044] In some embodiments, the X-ray powder diffractogram of the Form I of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.3 degrees, 7.3 degrees, 10.7 degrees, 13.9 degrees, 14.6 degrees, 16.3 degrees, 19.9 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0045] In some embodiments, the X-ray powder diffractogram of the Form I of the compound

of Formula A may have characteristic diffraction angles (2θ) of 5.3 degrees, 7.3 degrees, 10.7 degrees, 13.9 degrees, 14.6 degrees, 16.3 degrees, 19.9 degrees, 21.1 degrees, 21.3 degrees, and 25.8 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0046] In some embodiments, the X-ray powder diffractogram of the Form I of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.3 degrees, 7.3 degrees, 10.7 degrees, 13.9 degrees, 14.6 degrees, 15.2 degrees, 16.3 degrees, 19.9 degrees, 21.1 degrees, 21.3 degrees, 23.1 degrees, 23.3 degrees, and 25.8 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0047] In some embodiments, the Form I of the compound of Formula A may have an X-ray powder diffractogram as shown in Figure 1. But notwithstanding experimental and machine errors, and principles such as preferred orientation, one skilled in the art can find sufficient information in the XRPD data provided herein to identify Form I of the compound of Formula A and any other crystalline forms.

[0048] As disclosed herein, Form I of the compound of Formula A may also be characterized according to a DSC thermogram. In particular, the Form I of the compound of Formula A may have a DSC curve as shown in Figure 2. In the DSC thermogram, the endothermic peak of the Form I of the compound of Formula A is at about 247.3-248.3°C.

[0049] As disclosed herein, Form I of the compound of Formula A may also be characterized by thermogravimetric analysis (TGA). In particular, the Form I of the compound of Formula A may have a TGA curve as shown in Figure 3 indicating the Form I as described herein as an anhydrous material or a neat form.

[0050] In some embodiments, Form I of the compound of Formula A is substantially free of other crystalline Forms as described herein. For example, the content of Form I of the compound of Formula A is at least 99%, at least 95%, at least 90%, or even lower to 80%, by weight. Further for example, the content of Form I of the compound of Formula A is at least 70%, or at least 60%, by weight. Even further for example, the content of Form I of the compound of Formula A is at least 50% by weight.

Methods of Preparing Form I

Method A

[0051] Also provided herein is a method of preparing Form I of the compound of Formula A, comprising:

1. (1) mixing compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-*N*,2-dimethylbenzofuran-3-carboxamide with at least one dissolution solvent or dissolution solvent mixture, and heating the mixture to reflux to obtain a solution;
wherein, said at least one dissolution solvent is selected from methanol, C₃₋₆ alkanol, acetic acid, and aprotic solvent; said dissolution solvent mixture is selected from a mixture of two or more aprotic solvents, or a mixture of water miscible organic solvent and water, in which the volume percentage of the water miscible organic solvent in said dissolution solvent mixture is less than about 50%;
2. (2) cooling the solution obtained in step (1) to ambient temperature slowly; then
3. (3) isolating to obtain the solid of Form I of the compound of Formula A;
4. (4) drying the solid obtained in step (3).

[0052] In some embodiments, said C₃₋₆ alkanol is, such as n-propanol, i-propanol, n-butanol, i-butanol, s-butanol, t-butanol, n-pentanol, n-hexanol, and the like.

[0053] In some embodiments, said aprotic solvents are selected from acetone, methyl ethyl ketone, toluene, acetonitrile, N,N-dimethylformamide(DMF), tetrahydrofuran(THF), dichloromethane(DCM), and C₅₋₈ straight or branched alkane, such as n-heptane.

[0054] In some embodiments, said water miscible organic solvent is selected from acetone, methanol, ethanol, and acetonitrile.

[0055] In some embodiments, the volume percentage of said water miscible organic solvent in said dissolution solvent mixture is less than about 35%.

[0056] In some embodiments, said water miscible organic solvent and water are mixed in proper ratio. In some embodiments, the volume ratio of the water miscible organic solvent and water is about 1:2, such as methanol / water (about 1/2 in V/V), ethanol/water(about 1/2 in V/V), acetonitrile/water(about 1/2 in V/V).

[0057] In some embodiments, said at least one dissolution solvent is selected from mixtures of two or three organic solvents, for example, mixtures of acetone and THF (in volume ratio from about 5/1 to about 1/7), mixtures of THF and acetonitrile (in volume ratio from about 1/3 to about 1/7), mixtures of DCM, acetic acid and n-heptane (about 4/1/5 in V/V/V), and the like.

[0058] In some embodiments, said cooling the solution to ambient temperature, can cool slowly while stirring, such as stirring at a moderate rate, for example at a rate ranging from 50 to 200 rpm.

[0059] In some embodiments, said drying temperature and drying time should be proper to ensure the solid be dried completely and keep the essential properties.

Method B

[0060] Also provided herein is an alternative method of preparing Form I of the compound of Formula A, comprising:

1. (1) mixing compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide with at least one dissolution solvent, then heating the mixture to reflux to obtain the first solution; wherein said dissolution solvent is selected from ethanol, isopropanol, acetone, dichloromethane, dimethyl sulfoxide(DMSO), and N,N-dimethylformamide;
2. (2) adding at least one anti-dissolution solvent to said first solution to obtain the second solution;
3. (3) leaving said second solution to cool spontaneously slowly to ambient temperature; then
4. (4) isolating to obtain the solid of Form I of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide;
5. (5) drying the solid obtained in step (4).

[0061] In some embodiments, said anti-dissolution solvent is selected from water, C₅₋₈ straight or branched alkane (such as n-heptane), and organic acid esters with not more than eight carbon atoms (such as ethyl acetate).

[0062] In some embodiments, said anti-dissolution solvent is selected from water, n-heptane, and ethyl acetate.

[0063] In some embodiments, the volume ratio of said dissolution solvent to the anti-dissolution solvent ranges from about 0.5:1 to about 2.5:1.

[0064] In some embodiments, the amount of said at least one dissolution solvent used in step (1) of method B is about 20 to 380 mL / 1 g the compound of Formula A (a volume/weight ratio).

Method C

[0065] Also provided herein is an alternative method of preparing Form I of the compound of Formula A, comprising:

1. (1) suspending the solid of compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide in an appropriate amount of a solvent system; wherein, said solvent system is selected from dissolution solvent (such as acetone), or a

- solvent mixture of water miscible organic solvent and water, in which volume percentage of water miscible organic solvent in the solvent mixture is less than about 80%;
2. (2) stirring the suspension obtained in step (1) for a period of time;
 3. (3) isolating to obtain the solid of Form I of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide;
 4. (4) drying the solid obtained in step (3).

[0066] In some embodiments, said solid of compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide used in step (1) may be a single crystal form, such as Form I, Form II or Form III, or a mixture of two or more of these forms.

[0067] In some embodiments, in said step (1), the compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide is not dissolved completely in the suspension system, wherein some remains as solid.

[0068] In some embodiments, said water miscible organic solvent is selected from acetone, methanol, ethanol, and acetonitrile. When the selected water miscible organic solvent is ethanol, the volume percentage of ethanol in the solvent system is not more than about 25%.

[0069] In some embodiments, said water miscible organic solvent and water are mixed in proper ratio. In some embodiments, the volume ratio of the water miscible organic solvent and water is from about 1:3 to about 1:9, or is about 1:1, such as ethanol/water (about 1/3 to about 1/9 in V/V), acetone/water (about 1/1 in V/V).

[0070] In some embodiments, heating is applied in said step (2) when stirring the suspension, and the heating temperature is not higher than the boiling point of the solvent system, such as about 40°C, about 60°C, and about 70°C. Said heating can facilitate the conversion of the solid in the suspension system to Form I of the compound of Formula A.

Ethanol solvate

[0071] Also disclosed herein is ethanol solvate of the compound of Formula A.

[0072] In some embodiments disclosed herein, ethanol solvate of the compound of Formula A is hemiethanol solvate.

[0073] In some embodiments disclosed herein, hemiethanol solvate of the compound of Formula A is Form II.

[0074] In some embodiments disclosed herein, Form II of hemiethanol solvate of the compound of Formula A may be characterized according to X-ray powder diffraction.

[0075] In some embodiments disclosed herein, the X-ray powder diffractogram of Form II of hemiethanol solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 8.2 degrees, 10.3 degrees, 12.1 degrees, and 13.2 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0076] In some embodiments disclosed herein, the X-ray powder diffractogram of Form II of hemiethanol solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 4.2 degrees, 4.6 degrees, 8.2 degrees, 9.3 degrees, 10.3 degrees, 12.1 degrees, 13.2 degrees, and 14.6 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0077] In some embodiments disclosed herein, the X-ray powder diffractogram of Form II of hemiethanol solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 4.2 degrees, 4.6 degrees, 7.2 degrees, 8.2 degrees, 9.3 degrees, 10.3 degrees, 12.1 degrees, 13.2 degrees, 14.6 degrees, and 18.2 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0078] In some embodiments disclosed herein, the X-ray powder diffractogram of Form II of hemiethanol solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 4.2 degrees, 4.6 degrees, 5.2 degrees, 7.2 degrees, 8.2 degrees, 9.3 degrees, 10.3 degrees, 12.1 degrees, 13.2 degrees, 14.6 degrees, 18.2 degrees, and 23.5 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0079] In some embodiments disclosed herein, the X-ray powder diffractogram of Form II of hemiethanol solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 4.2 degrees, 4.6 degrees, 5.2 degrees, 7.2 degrees, 8.2 degrees, 8.9 degrees, 9.3 degrees, 10.3 degrees, 11.4 degrees, 12.1 degrees, 13.2 degrees, 14.6 degrees, 18.2 degrees, 18.9 degrees, 20.4 degrees, 22.1 degrees, 23.5 degrees, and 26.2 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0080] In some embodiments disclosed herein, the Form II of hemiethanol solvate of the compound of Formula A may have an X-ray powder diffractogram as shown in Figure 4. But notwithstanding experimental and machine errors, and principles such as preferred orientation, one skilled in the art can find sufficient information in the XRPD data provided herein to identify Form II of hemiethanol solvate of the compound of Formula A and any other crystalline forms.

[0081] In some embodiments disclosed herein, Form II of hemiethanol solvate of the compound of Formula A may be characterized according to a DSC thermogram. In some embodiments, the Form II of hemiethanol solvate of the compound of Formula A has a DSC curve as shown in Figure 5. In the DSC thermogram, the endothermic peak of the Form II of hemiethanol solvate of the compound of Formula A is at about 245.7-247.0°C.

[0082] In some embodiments disclosed herein, Form II of hemiethanol solvate of the

compound of Formula A may be characterized by thermogravimetric analysis (TGA). In some embodiments disclosed herein, the Form II of hemiethanol solvate of the compound of Formula A has a TGA curve as shown in Figure 6 indicating the Form II as described herein as a hemiethanol solvate.

[0083] In some embodiments disclosed herein, Form II of hemiethanol solvate of the compound of Formula A is substantially free of other crystalline Forms as described herein. For example, the content of Form II of hemiethanol solvate of the compound of Formula A is at least 99%, at least 95%, at least 90%, or even lower to 80%, by weight. Further for example, the content of Form II of hemiethanol solvate of the compound of Formula A is at least 70%, or at least 60%, by weight. Even further for example, the content of Form II of hemiethanol solvate of the compound of Formula A is at least 50% by weight.

Method of Preparing Form II

Method A

[0084] Also disclosed herein is a method of preparing Form II of hemiethanol solvate of the compound of Formula A, comprising:

1. (1) mixing compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide with at least one dissolution solvent, and heating the mixture to reflux to obtain a solution;
wherein, said dissolution solvent is selected from ethanol, or a solvent mixture of ethanol and an aprotic solvent, in which volume percentage of ethanol in the solvent mixture is not less than about 65%;
2. (2) cooling the solution obtained in step (1) to ambient temperature slowly; then
3. (3) isolating to obtain the solid of Form II of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide;
4. (4) drying the solid obtained in step (3).

[0085] In some embodiments disclosed herein, said aprotic solvent is tetrahydrofuran or water. In some embodiments disclosed herein, said ethanol and aprotic solvent are mixed in proper ratio to form the solvent mixture. In some embodiments disclosed herein, the volume ratio of ethanol and aprotic solvent is about 5:1 or about 2:1, such as ethanol / tetrahydrofuran (about 5/1 in V/V), ethanol/water (about 2/1 in V/V).

[0086] In some embodiments disclosed herein, said cooling the solution to ambient temperature, can cool slowly while stirring, such as stirring at a moderate rate, for example at a rate ranging from 50 to 200 rpm.

[0087] In some embodiments disclosed herein, proper drying temperature and drying time is required to ensure the solid be dried completely and keep the wanted crystal form properties.

Method B

[0088] Also disclosed herein is an alternative method of preparing Form II of hemiethanol solvate of the compound of Formula A, comprising:

1. (1) mixing compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide with at least one dissolution solvent, then heating the mixture to reflux to obtain the first solution;
wherein, said dissolution solvent is selected from ethanol, or a solvent mixture of ethanol and a weak organic acid;
2. (2) adding at least one anti-dissolution solvent to said first solution at refluxing temperature to obtain the second solution, wherein said anti-dissolution solvent is C₅₋₈ straight or branched alkane, such as n-heptane;
3. (3) leaving said second solution to cool spontaneously slowly to ambient temperature; then
4. (4) isolating to obtain the solid of Form II of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide;
5. (5) drying the solid obtained in step (4).

[0089] In some embodiments disclosed herein, said weak organic acid is acetic acid. In some more specific embodiments disclosed herein, the volume ratio of ethanol and acetic acid is about 1:3.

[0090] In some embodiments disclosed herein, the volume percentage of ethanol in the solvent system (total amount of the dissolution solvent and the anti-dissolution solvent) is not less than about 30%.

[0091] In some embodiments disclosed herein, the amount of said dissolution solvent system consisting of ethanol and a weak organic acid is 60 to 300 mL / 1 g Compound A used in step (1) (a volume/weight ratio).

Method C

[0092] Also disclosed herein is an alternative method of preparing Form II of hemiethanol solvate of the compound of Formula A, comprising:

1. (1) suspending the solid of compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-

dimethylbenzofuran-3-carboxamide in an appropriate amount of a solvent system; wherein, said solvent system is selected from ethanol, a solvent mixture of ethanol and C₅₋₈ straight or branched alkane (such as n-heptane), or a solvent mixture of ethanol and water, in which volume percentage of ethanol in the solvent mixture of ethanol and water is not less than about 80%;

2. (2) stirring the suspension obtained in step (1) for a period of time at certain temperature range;
3. (3) isolating to obtain the Form II of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide.

[0093] In some embodiments disclosed herein, said solid of compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide used in step (1) may be a single crystal form, such as Form I, Form II, Form III or Form IV, or a mixture of two or more of these forms.

[0094] In some embodiments disclosed herein, the volume ratio of ethanol and C₅₋₈ straight or branched alkane (such as n-heptane) in said solvent mixture is about 1:4. In some embodiments disclosed herein, the proper volume ratio of ethanol and water is about 4:1.

[0095] As described herein, the stirring is carried out at temperature less than the boiling point of the solvent system, such as at room temperature, about 40°C and about 60°C.

Form III

[0096] Also disclosed herein is Form III of the compound of Formula A.

[0097] In some embodiments disclosed herein, Form III of the compound of Formula A may be characterized according to X-ray powder diffraction.

[0098] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form III of the compound of Formula A may have characteristic diffraction angles (2θ) of 7.2 degrees, 8.6 degrees, 14.4 degrees, and 15.2 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0099] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form III of the compound of Formula A may have characteristic diffraction angles (2θ) of 4.9 degrees, 7.2 degrees, 8.6 degrees, 12.0 degrees, 14.4 degrees, 15.2 degrees, 25.4 degrees, and 26.1 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0100] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form III of the compound of Formula A may have characteristic diffraction angles (2θ) of 4.9 degrees,

7.2 degrees, 8.6 degrees, 12.0 degrees, 14.4 degrees, 15.2 degrees, 25.4 degrees, 26.1 degrees, and 29.1 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0101] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form III of the compound of Formula A may have characteristic diffraction angles (2θ) of 4.9 degrees, 7.2 degrees, 8.6 degrees, 12.0 degrees, 14.4 degrees, 15.2 degrees, 16.2 degrees, 20.4 degrees, 22.4 degrees, 25.4 degrees, 26.1 degrees, 29.1 degrees, and 32.7 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0102] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form III of the compound of Formula A may have characteristic diffraction angles (2θ) of 4.9 degrees, 7.2 degrees, 8.6 degrees, 12.0 degrees, 14.4 degrees, 15.2 degrees, 16.2 degrees, 17.3 degrees, 19.9 degrees, 20.4 degrees, 22.4 degrees, 24.0 degrees, 24.3 degrees, 24.9 degrees, 25.4 degrees, 26.1 degrees, 29.1 degrees, and 32.7 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0103] In some embodiments disclosed herein, the Form III of the compound of Formula A may have an X-ray powder diffractogram as shown in Figure 7. But notwithstanding experimental and machine errors, and principles such as preferred orientation, one skilled in the art can find sufficient information in the XRPD data provided herein to identify Form III and any other crystalline forms.

[0104] In some embodiments disclosed herein, Form III of the compound of Formula A may be characterized according to a DSC thermogram. In some embodiments disclosed herein, the Form III of the compound of Formula A has a DSC curve as shown in Figure 8. In the DSC thermogram, the endothermic peak of the Form III of the compound of Formula A is at about 248.0-249.0°C.

[0105] In some embodiments disclosed herein, Form III of the compound of Formula A may be characterized by thermogravimetric analysis (TGA). In some embodiments disclosed herein, the Form III of the compound of Formula A has a TGA curve as shown in Figure 9 indicating the Form III as an anhydrous material or a neat form.

[0106] In some embodiments disclosed herein, said Form III of the compound of Formula A is substantially free of other crystalline Forms as described herein. For example, the content of Form III is at least 99%, at least 95%, at least 90%, or even lower to 80%, by weight. Further for example, the content of Form III is at least 70%, or at least 60%, by weight. Even further for example, the content of Form III is at least 50% by weight.

Method of Preparing Form III

[0107] Also disclosed herein is a method of preparing Form III of the compound of Formula A, comprising:

1. (1) mixing compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide with a solvent mixture of an aprotic solvent and water, wherein the volume ratio of said aprotic solvent and water in the solvent mixture is no less than about 1:2.5, and heating the mixture to obtain a solution;
2. (2) cooling the solution obtained in step (1) to ambient temperature slowly; then
3. (3) isolating to obtain the Form III of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide.

[0108] In some embodiments disclosed herein, said aprotic solvent is selected from tetrahydrofuran and acetonitrile.

[0109] In some embodiments disclosed herein, said aprotic solvent and water are mixed in proper volume ratio to form a dissolution solvent. For example, the volume ratio of said aprotic solvent and water ranges from about 1:1 to about 7:1, such as tetrahydrofuran/water (about 1/1 in V/V to about 3/1 in V/V), acetonitrile/water (about 1/1 in V/V to about 7/1 in V/V).

[0110] In some embodiments disclosed herein, in said step (1), heating the mixture to reflux or to such as about 72°C.

[0111] Cooling the solution to ambient temperature, as described herein, can be slowly cooled while stirring, such as cooled while stirring at a moderate rate, for example at a rate ranging from 50 to 200 rpm.

Acetic acid solvate

[0112] Also disclosed herein is acetic acid solvate of the compound of Formula A.

[0113] In some embodiments disclosed herein, acetic acid solvate of the compound of Formula A is monoacetic acid solvate.

[0114] In some embodiments disclosed herein, monoacetic acid solvate of the compound of Formula A is Form IV.

[0115] In some embodiments disclosed herein, Form IV of monoacetic acid solvate of the compound of Formula A may be characterized according to X-ray powder diffraction.

[0116] In some embodiments disclosed herein, the X-ray powder diffractogram of Form IV of monoacetic acid solvate of the compound of Formula A may have characteristic diffraction

angles (2θ) of 5.7 degrees, 7.6 degrees, 10.5 degrees, and 11.5 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0117] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form IV of monoacetic acid solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.7 degrees, 7.6 degrees, 10.1 degrees, 10.5 degrees, 11.5 degrees, 13.3 degrees, 15.4 degrees, and 17.3 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0118] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form IV of monoacetic acid solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.7 degrees, 7.6 degrees, 10.1 degrees, 10.5 degrees, 11.5 degrees, 13.3 degrees, 15.4 degrees, 17.3 degrees, and 20.2 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0119] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form IV of monoacetic acid solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.7 degrees, 7.6 degrees, 10.1 degrees, 10.5 degrees, 11.5 degrees, 13.3 degrees, 15.4 degrees, 17.3 degrees, 20.2 degrees, 21.2 degrees, 22.7 degrees, 26.4 degrees, 26.9 degrees, 31.0 degrees, and 32.9 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0120] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form IV of monoacetic acid solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.7 degrees, 7.6 degrees, 10.1 degrees, 10.5 degrees, 11.5 degrees, 13.3 degrees, 15.4 degrees, 16.3 degrees, 17.3 degrees, 18.1 degrees, 20.2 degrees, 21.2 degrees, 22.1 degrees, 22.7 degrees, 26.4 degrees, 26.9 degrees, 29.7 degrees, 31.0 degrees, 32.0 degrees, and 32.9 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0121] In some embodiments disclosed herein, the Form IV of monoacetic acid solvate of the compound of Formula A may have an X-ray powder diffractogram as shown in Figure 10. But notwithstanding experimental and machine errors, and principles such as preferred orientation, one skilled in the art can find sufficient information in the XRPD data provided herein to identify Form IV of monoacetic acid solvate of the compound of Formula A and any other crystalline forms.

[0122] In some embodiments disclosed herein, Form IV of monoacetic acid solvate of the compound of Formula A may be characterized according to a DSC thermogram. In some embodiments disclosed herein, the Form IV of monoacetic acid solvate of the compound of Formula A has a DSC curve as shown in Figure 11. In the DSC thermogram, the endothermic peak of the Form IV of monoacetic acid solvate of the compound of Formula A is at about 245.1-247.4°C.

[0123] In some embodiments disclosed herein, Form IV of monoacetic acid solvate of the compound of Formula A may be characterized by thermogravimetric analysis (TGA). In some embodiments disclosed herein, the Form IV of monoacetic acid solvate of the compound of Formula A has a TGA curve as shown in Figure 12 indicating the Form IV as described herein as a monoacetic acid solvate.

[0124] In some embodiments disclosed herein, Form IV of monoacetic acid solvate of the compound of Formula A is substantially free of other crystalline Forms as described herein. For example, the content of Form IV of monoacetic acid solvate of the compound of Formula A is at least 99%, at least 95%, at least 90%, or even lower to 80%, by weight. Further for example, the content of Form IV of monoacetic acid solvate of the compound of Formula A is at least 70%, or at least 60%, by weight. Even further for example, the content of Form IV of monoacetic acid solvate of the compound of Formula A is at least 50% by weight.

Method of Preparing Form IV

[0125] Also disclosed herein is a method of preparing Form IV of monoacetic acid solvate of the compound of Formula A, comprising:

1. (1) mixing compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide with the solvent system containing acetic acid, and heating the mixture to reflux to obtain the first solution;
2. (2) adding at least one anti-dissolution solvent to the first solution to obtain the second solution;
3. (3) leaving the second solution to cool spontaneously slowly to ambient temperature; then
4. (4) isolating to obtain the Form IV of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide.

[0126] In some embodiments disclosed herein, said solvent system is selected from a solvent mixture of acetic acid and haloalkane with less than three carbon atoms (such as dichloromethane), or acetic acid alone is used as the solvent system. In some more specific embodiments disclosed herein, the percentage of acetic acid in said solvent system is not lower than 5%. In some more specific embodiments disclosed herein, the volume ratio of acetic acid and dichloromethane is about 5:1.

[0127] In some embodiments disclosed herein, said anti-dissolution solvent is selected from C₅₋₈ straight or branched alkane, such as n-heptane.

[0128] In some embodiments disclosed herein, the volume ratio of said anti-dissolution solvent to the solvent system is not less than about 1:1.

[0129] In some embodiments disclosed herein, the amount of the solvent system used in step (1) of said method is about 20 to 30 mL / 1 g Compound A (a volume/weight ratio).

Form VII

[0130] Also disclosed herein is Form VII of the compound of Formula A.

[0131] In some embodiments disclosed herein, Form VII of the compound of Formula A may be characterized according to X-ray powder diffraction.

[0132] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form VII of the compound of Formula A may have characteristic diffraction angles (2θ) of 9.0 degrees, 11.8 degrees, and 13.6 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0133] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form VII of the compound of Formula A may have characteristic diffraction angles (2θ) of 6.8 degrees, 9.0 degrees, 11.8 degrees, 13.6 degrees, 14.9 degrees, and 18.2 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0134] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form VII of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.9 degrees, 6.8 degrees, 7.1 degrees, 9.0 degrees, 11.8 degrees, 13.6 degrees, 14.9 degrees, and 18.2 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0135] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form VII of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.9 degrees, 6.8 degrees, 7.1 degrees, 9.0 degrees, 11.8 degrees, 13.6 degrees, 14.9 degrees, 18.2 degrees, 21.4 degrees, 23.7 degrees, and 26.0 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0136] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form VII of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.9 degrees, 6.8 degrees, 7.1 degrees, 9.0 degrees, 11.8 degrees, 13.6 degrees, 14.9 degrees, 18.2 degrees, 19.1 degrees, 19.7 degrees, 21.4 degrees, 23.7 degrees, 26.0 degrees, 27.5 degrees, 28.1 degrees, 29.1 degrees, and 30.0 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0137] In some embodiments disclosed herein, the Form VII of the compound of Formula A may have an X-ray powder diffractogram as shown in Figure 13. But notwithstanding experimental and machine errors, and principles such as preferred orientation, one skilled in the art can find sufficient information in the XRPD data provided herein to identify Form VII of

the compound of Formula A and any other crystalline forms.

[0138] In some embodiments disclosed herein, Form VII of the compound of Formula A may be characterized according to a DSC thermogram. In some embodiments disclosed herein, the Form VII of the compound of Formula A has a DSC curve as shown in Figure 14. In the DSC thermogram, the endothermic peak of the Form VII of the compound of Formula A is at about 245.4-247.8°C.

[0139] In some embodiments disclosed herein, Form VII of the compound of Formula A may be characterized by thermogravimetric analysis (TGA). In some embodiments disclosed herein, the Form VII of the compound of Formula A has a TGA curve as shown in Figure 15 indicating the Form VII as described herein as an anhydrous material or a neat form.

[0140] In some embodiments disclosed herein, Form VII of the compound of Formula A is substantially free of other crystalline Forms as described herein. For example, the content of Form VII of the compound of Formula A is at least 99%, at least 95%, at least 90%, or even lower to 80%, by weight. Further for example, the content of Form VII of the compound of Formula A is at least 70%, or at least 60%, by weight. Even further for example, the content of Form VII of the compound of Formula A is at least 50% by weight.

Method of Preparing Form VII

[0141] Also disclosed herein is a method of preparing Form VII of the compound of Formula

[0142] A, comprising:

1. (1) mixing compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide with solvent mixture of an aprotic solvent and water, wherein the volume ratio of said aprotic solvent and water in the solvent mixture is about 1:1, and heating the mixture to reflux to obtain a solution;
2. (2) cooling the solution obtained in step (1) to ambient temperature slowly; then
3. (3) isolating the solid precipitates obtained in step (2);
4. (4) drying the solid to get the Form VII of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide.

[0143] In some embodiments disclosed herein, said aprotic solvent is selected from tetrahydrofuran.

[0144] In some embodiments disclosed herein, said cooling the solution to ambient temperature, can be slowly cooled while stirring, such as cooled while stirring at a moderate rate, for example at a rate ranging from 50 to 200 rpm.

[0145] In some embodiments disclosed herein, the drying conditions in step (4) are selected from ambient pressure to vacuums, and temperature from room temperature to about 55°C, and drying time from about 16 hours to about 48 hours.

Dioxane solvate

[0146] Also disclosed herein is dioxane solvate of the compound of Formula A.

[0147] In some embodiments disclosed herein, dioxane solvate of the compound of Formula A is monodioxane solvate.

[0148] In some embodiments disclosed herein, monodioxane solvate of the compound of Formula A is Form VIII.

[0149] In some embodiments disclosed herein, Form VIII of monodioxane solvate of the compound of Formula A may be characterized according to X-ray powder diffraction. In some embodiments disclosed herein, the X-ray powder diffractogram of Form VIII of monodioxane solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 9.0 degrees, 14.5 degrees, 16.3 degrees, and 16.8 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0150] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form VIII of monodioxane solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.7 degrees, 8.2 degrees, 9.0 degrees, 11.4 degrees, 14.5 degrees, 16.3 degrees, and 16.8 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0151] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form VIII of monodioxane solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.7 degrees, 8.2 degrees, 9.0 degrees, 11.4 degrees, 12.7 degrees, 14.5 degrees, 16.3 degrees, 16.8 degrees, 22.9 degrees, and 25.9 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0152] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form VIII of monodioxane solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.7 degrees, 8.2 degrees, 9.0 degrees, 11.4 degrees, 12.7 degrees, 14.5 degrees, 16.3 degrees, 16.8 degrees, 17.9 degrees, 22.9 degrees, 25.9 degrees, and 29.8 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0153] In some embodiments disclosed herein, the X-ray powder diffractogram of the Form VIII of monodioxane solvate of the compound of Formula A may have characteristic diffraction angles (2θ) of 5.7 degrees, 8.2 degrees, 9.0 degrees, 11.4 degrees, 12.7 degrees, 14.5

degrees, 16.3 degrees, 16.8 degrees, 17.9 degrees, 20.3 degrees, 21.6 degrees, 21.9 degrees, 22.9 degrees, 23.7 degrees, 24.5 degrees, 25.9 degrees, 29.2 degrees, 29.8 degrees, 33.9 degrees, and 37.4 degrees, each of the diffraction angles having an error of about ± 0.2 degrees (2θ).

[0154] In some embodiments disclosed herein, the Form VIII of monodioxane solvate of the compound of Formula A may have an X-ray powder diffractogram as shown in Figure 16. But notwithstanding experimental and machine errors, and principles such as preferred orientation, one skilled in the art can find sufficient information in the XRPD data provided herein to identify Form VIII of monodioxane solvate of the compound of Formula A and any other crystalline forms.

[0155] In some embodiments disclosed herein, Form VIII of monodioxane solvate of the compound of Formula A may be characterized according to a DSC thermogram. In some embodiments disclosed herein, the Form VIII of monodioxane solvate of the compound of Formula A has a DSC curve as shown in Figure 17. In the DSC thermogram, the endothermic peak of the Form VIII of monodioxane solvate of the compound of Formula A is at about 245.6-248.3°C.

[0156] In some embodiments disclosed herein, Form VIII of monodioxane solvate of the compound of Formula A may be characterized by thermogravimetric analysis (TGA). In some embodiments disclosed herein, the Form VIII of monodioxane solvate of the compound of Formula A has a TGA curve as shown in Figure 18 indicating the Form VIII as described herein as a monodioxane solvate.

[0157] In some embodiments disclosed herein, Form VIII of monodioxane solvate of the compound of Formula A is substantially free of other crystalline Forms as described herein. For example, the content of Form VIII of monodioxane solvate of the compound of Formula A is at least 99%, at least 95%, at least 90%, or even lower to 80%, by weight. Further for example, the content of Form VIII of monodioxane solvate of the compound of Formula A is at least 70%, or at least 60%, by weight. Even further for example, the content of Form VIII of monodioxane solvate of the compound of Formula A is at least 50% by weight.

Method of Preparing Form VIII

[0158] Also disclosed herein is a method of preparing Form VIII of monodioxane solvate of the compound of Formula A, comprising:

1. (1) mixing compound 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide with dioxane, and heating the mixture to reflux to obtain a solution;
2. (2) cooling the solution obtained in step (1) to ambient temperature slowly; then
3. (3) isolating to obtain the Form VIII of 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamide.

[0159] In some embodiments disclosed herein, the amount of dioxane used in said step (1) is not less than about 80 mL / 1 g the compound of Formula A (a volume/weight ratio).

[0160] The features of each embodiment in above methods of preparing the crystalline forms of the compound of Formula A or its solvates can be arbitrary combined, each embodiment obtained from such mutual combinations is included within the scope of the present invention or the present disclosure, as these embodiments obtained from such mutual combinations are specifically and individually listed herein.

Pharmaceutical Compositions and Form I for Use in Treatment

[0161] Form I of the compound of Formula A according to the present invention, as well as the further disclosed crystalline forms of the compound of Formula A, its solvates and the crystalline forms thereof (such as Form II, Form III, Form IV, Form VII, and Form VIII), may be used for the treatment of diseases mediated by KDR, such as angiogenesis-related disorders.

[0162] For example, the angiogenesis-related disorders include age-related vascular degenerative disease, such as age-related macular degeneration, cancer, and chronic inflammatory disease. Cancers as described herein include but are not limited to lung cancer, head and neck cancer, colorectal cancer, pancreatic cancer, colon cancer, breast cancer, ovarian cancer, prostate cancer, stomach cancer, kidney cancer, liver cancer, brain cancer, bone cancer, sarcoma, such as soft tissue sarcoma, and leukemia.

[0163] Provided herein is Form I of the compound of Formula A for use in treating diseases associated with KDR, such as angiogenesis-related disorders.

[0164] In some embodiments, the treatment is against at least one disease associated with KDR, such as angiogenesis-related disorders, for example cancer. Wherein, a subject in recognized need of treatment is to be administered an effective amount of a pharmaceutical composition comprising: at least one pharmaceutically acceptable carrier and Form I of the compound of Formula A, to provide said treatment.

[0165] The amount of Form I effective for achieving the desired biological effect may depend on a number of factors, for example, the intended use, the mode of administration, and the clinical condition of the patient. The daily dose may, for example, range from 0.01 mg to 3 g/day (such as from 0.05 mg to 2 g /day, for example from 100 mg to 1g /day). Unit dose formulations which can be administered orally include, for example, tablets or capsules.

[0166] For the therapy of the above-mentioned conditions, the Form I of the compound of Formula A may be administered in form of the compound itself, but typically would be used in

the form of a pharmaceutical composition with one or more pharmaceutically acceptable carriers/excipients.

[0167] Representative carriers/excipients should be compatible with the other ingredients of the composition and not harmful for the patient's health. The carrier/excipient may be a solid or a liquid or both, and may be formulated with the Form I of the compound of Formula A, to a pharmaceutical composition or a unit dosage form (for example, a tablet, a capsule), which may contain from 0.05% to 95% by weight of Form I of the compound of Formula A described herein. The pharmaceutical compositions described herein can be produced by known pharmaceutical methods, such as those involving mixing the ingredients with pharmaceutically acceptable carriers and/or excipients and diluents.

[0168] In some embodiments, representative carriers or excipients would include but are not limited to: microcrystalline cellulose, lactose, sodium citrate, calcium carbonate, dicalcium phosphate, glycine, disintegrants such as starch, sodium cross-linked carboxymethyl cellulose, composite silicates, and polyethylene glycol with high molecular weight, granulation binders (such as polyvinylpyrrolidone, sucrose, gelatin, and Gum Arabic), and lubricants (such as magnesium stearate, glycerin, and talc). In some embodiments, the Form I of the compound of Formula A may be combined with at least one component, such as carrier and/or excipient and/or diluent, selected from sweeteners, flavoring agents, coloring agents, dyes, and emulsifiers.

[0169] In some embodiments, the conversion of Form I of the compound of Formula A will not occur upon formulation with the one or more pharmaceutically acceptable carriers and/or excipients and/or diluents. In other embodiments, Form I of the compound of Formula A may be converted, in whole or in part, to one or more other forms, including a non-solid form, upon formulation with the one or more pharmaceutically acceptable carriers and/or diluents and/or excipients. Exemplary carriers and/or diluents and/or excipients would include but are not limited to, water, ethanol, propylene glycol, glycerine, and mixtures thereof. In some embodiments, the Form I or other forms disclosed herein can be dissolved when formulated into a pharmaceutical composition. Accordingly, in such "dissolved" cases, the Form I or other forms no longer exists in their respective crystalline forms in the pharmaceutical composition.

[0170] In some embodiments, the Form I of the compound of Formula A is formulated to a suitable dosage form.

[0171] Pharmaceutical compositions described herein can be dosage forms suitable for oral and oral cavity (for example sublingual) administration, although the suitable mode of administration may depend in each individual case on the nature and severity of the condition to be treated and on the nature of the active pharmaceutical ingredient, i.e. the Form I of the compound of Formula A, used in each case to prepare the pharmaceutical composition. Pharmaceutical compositions described herein can be coated dosage forms or coated sustained-release dosage forms. Acid- and gastric juice-resistant dosage forms are also possible. Suitable coatings resistant to gastric juice comprise cellulose acetate phthalate,

polyvinyl acetate phthalate, hydroxypropylmethylcellulose phthalate, anionic polymers of methacrylic acid, and methyl methacrylate.

[0172] Suitable pharmaceutical compositions for oral administration prepared from the Form I of the compound of Formula A may be in the form of unit dosage forms such as capsules, cachets, and tablets, including suckable tablets, each of which is prepared with a defined amount of the Form I; as well as in the forms selected from powders, granules, solutions, suspensions in an aqueous or nonaqueous liquid, and oil-in-water and water-in-oil emulsions. Those compositions may, as already mentioned, be prepared by any suitable pharmaceutical formulation methods, such as those including a step wherein the Form I of the compound of Formula A and a carrier and/or excipient and/or diluent (which may consist of one or more added ingredients) are brought into contact. The compositions can generally be produced by uniformly and homogeneously mixing the Form I of the compound of Formula A with liquid or finely divided solid carriers, after which the product can be shaped.

[0173] The compositions described herein can be administered topically or systemically.

[0174] Pharmaceutical compositions which are suitable for peroral (including sublingual) administration can comprise suckable tablets which comprise the Form I of the compound of Formula A, and a flavoring agent. The flavoring agent is selected from sucrose, gum arabic, tragacanth, and the like.

[0175] Pharmaceutical compositions described herein can also be those forms suitable for parenteral administration, such as by inhalation spray, or via an implanted reservoir. Solid carriers used therein include, for example, starch, lactose, microcrystalline cellulose, aluminum silicate, and any ingredients suitable for intended use. Liquid carriers include, for example, injectable water, polyvinyl alcohol, non-ionized surfactant agents, and corn oil, and any ingredients suitable for intended use. Other excipients commonly used in pharmaceutical formulation include coloring agents, preservatives, flavoring agents and antioxidants such as vitamin E, vitamin A, BHT and BHA.

[0176] The Form I of the compound of Formula A described herein, can also be administered intraperitoneally. And the solution and suspension of that compound can be prepared by dissolving or suspending the compound in water containing suitable surfactants. Dispersed suspensions can be prepared by using glycerol, polyethylene glycol (PEG) or their mixture with suitable oils. Preservatives can be added to those formulations to prevent growth of microorganisms during use.

[0177] Injectable formulation includes solution or suspension in sterilized water, and sterilized powder. In all cases, those formulations must be sterilized and easily removed from the syringe, and stable under the manufacture and storage conditions, and free from pollution and the infection of microorganisms. Carriers can be solvents or dispersing agents, and include water, alcohol, and some suitable oils.

[0178] The Form I of the compound of Formula A can also be administered in combination with one or more other active ingredients (such as in the synergetic therapy). When administered as a combination, the active ingredients can be formulated as separate compositions that are administered at the same time or sequentially at different times (such as administered sequentially in any orders) through the same or different administration routes, or the active ingredients can be administered in the same pharmaceutical composition.

[0179] In some embodiments, the Form I of the compound of Formula A can be administered in combination with one or more other active ingredients with known therapeutical effect, for example for the treatment of diseases associated with KDR, such as angiogenesis-related disorders.

[0180] The phrase "in combination with", as used herein, defines the combined use of the Form I of the compound of Formula A with one or more other active ingredients, such as, the combined use in the anti-neoplastic method. As used herein, the term "anti-neoplastic method" refers to the respective agent(s) for use in any method for purposes of treating the cancer. Examples of anti-neoplastic method include but are not limited to: radiotherapy, immunotherapy, DNA damaging chemotherapy, and chemotherapy that disrupts cell replication.

[0181] Non-limiting examples of DNA damaging chemotherapeutic agents include, for example, topoisomerase I inhibitors (e.g., irinotecan, topotecan, camptothecin and analogs or metabolites thereof, and doxorubicin); topoisomerase II inhibitors (e.g., etoposide, teniposide, and daunorubicin); alkylating agents (e.g., melphalan, chlorambucil, busulfan, thiotepa, ifosfamide, carmustine, lomustine, semustine, streptozocin, decarbazine, methotrexate, mitomycin C, and cyclophosphamide); DNA intercalators (e.g., cisplatin, oxaliplatin, and carboplatin); DNA intercalators and free radical generators such as bleomycin; and nucleoside mimetics (e.g., 5-fluorouracil, capecitabine, gemcitabine, fludarabine, cytarabine, mercaptopurine, thioguanine, pentostatin, and hydroxyurea).

[0182] Chemotherapeutic agents that disrupt cell replication include but are not limited to: paclitaxel, docetaxel, and related analogs; vincristine, vinblastin, and related analogs; thalidomide and related analogs (e.g., CC-5013 and CC-4047); protein tyrosine kinase inhibitors (e.g., imatinib mesylate and gefitinib); proteasome inhibitors (e.g., bortezomib); NF-kappa B inhibitors, including inhibitors of I kappa B kinase; antibodies which bind to proteins overexpressed in cancers and thereby downregulate cell replication (e.g., rituximab, cetuximab, and bevacizumab); and other inhibitors of proteins or enzymes known to be upregulated, over-expressed, or activated in cancers, the inhibition of which can downregulates cell replication.

[0183] Thus, the treatments described herein are not limited in the sequence of administration; the Form I of the compound of Formula A may be administered either prior to, at the same time with or after administration of the one or more other active ingredients. At least one active pharmaceutical ingredient in the combination described above is Form I of the compound of

Formula A.

[0184] The following non-limiting examples are provided.

Experiments

[0185] The compound of Formula A material used in the examples are prepared according to WO 2009/137797 A2.

[0186] All reagents, except intermediates, used in this disclosure are commercially available. All compound names except the reagents were generated by ChemBioDraw Ultra 12.0.

[0187] Unless otherwise indicated, powder X-ray diffractograms were obtained using

[0188] Germany Bruker D8 ADVANCE X-ray diffractometer, with radiation generated from a CuK α source at 40mA and 40kV, and the instrument can be operated over the 2 θ range of 3-45° with scan step of 0.02° and scanning speed at 4° /min.

[0189] DSC thermal analyses were performed on PerkinElmer DSC 7, in which nitrogen was used as the purge gas at a flow rate of 50 mL min⁻¹. The samples were measured in crimped aluminum pans. The instruments were calibrated for temperature using indium. Sample tests of DSC experiments were carried out in the conventional mode at a heating rate of 5-10°C min⁻¹ with the temperature ranging from 25 to 200°C.

[0190] Thermogravimetric (TG) curves, were obtained by using Perkin-Elmer Thermal TGA7, with N₂ as a purge gas at a flow rate of 50 mL min⁻¹, the heating rate is 10°C/min.

Example 1: Preparation of Form I of the compound of Formula A

[0191] 95mg of the compound of Formula A was dissolved in 36mL of acetone under heating and stirring, filtered while hot, cooled the filtrate naturally to room temperature, filtered out the precipitates, dried at 60°C under vacuum, got the white powder 64mg, yield 67.4%, m.p. (DSC): 247.31-248.33°C.

[0192] The obtained powder sample is Form I of the compound of Formula A, the powder X-ray diffractogram of which is shown in Figure 1, and the main data are shown in Table 1. Peaks (2 θ) chosen from the figure has the following values: 5.302, 7.313, 10.684, 13.862, 14.590, 15.194, 16.304, 17.528, 19.165, 19.876, 21.137, 21.394, 23.145, 25.809, 26.458, each of the diffraction angles having an error of about ± 0.2 degrees (2 θ), wherein characteristic peaks (2 θ) are identified as 5.302, 10.684, 13.862, and 14.590.

[0193] DSC testing shows that the melting point range of the Form I obtained is 247.31-248.33°C.

Table 1

#	2θ	Height	I%	Area	I%
1	5.302	4006	86.7	33918	88.4
2	7.313	1399	30.3	11679	30.5
3	10.684	3495	75.6	29404	76.7
4	13.862	4620	100.0	38350	100.0
5	14.590	1856	40.2	15491	40.4
6	15.194	306	6.6	1096	2.9
7	16.304	663	14.4	4800	12.5
8	19.876	1540	33.3	12970	33.8
9	21.137	499	10.8	3651	9.5
10	21.394	622	13.5	5417	14.1
11	23.145	697	15.1	16722	43.6
12	23.345	612	13.2	20885	54.5
13	25.809	1474	31.9	26498	69.1

Example 2: Preparation of Form I of the compound of Formula A

[0194] 100mg of the compound of Formula A was dissolved in 25mL of methyl ethyl ketone under heating and stirring, then stopped heating, the solution was cooled naturally to room temperature, the solid was collected by filtration to obtain the Form I of the compound of Formula A. The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 3: Preparation of Form I of the compound of Formula A

[0195] 100mg of the compound of Formula A was dissolved in 20mL of n-propanol under heating and stirring, then stopped heating, the solution was cooled naturally to room temperature, the solid was collected by filtration to obtain the Form I of the compound of Formula A.

[0196] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 4: Preparation of Form I of the compound of Formula A

[0197] 96.5mg of the compound of Formula A was dissolved in 25mL of toluene under heating and stirring, then cooled the solution naturally to room temperature, filtered out the precipitates, dried at 60°C under vacuum, got the white powder 75.8mg, yield 78.5%.

[0198] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 5: Preparation of Form I of the compound of Formula A

[0199] 524.5mg of the compound of Formula A was dissolved in 18mL of N,N-dimethylformamide under heating and stirring, then cooled the solution naturally to room temperature, crystals appeared at about 60°C, then stirred overnight, filtered out the precipitates, got the white powder 449.2mg, yield 85.6%.

[0200] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 6: Preparation of Form I of the compound of Formula A

[0201] 0.5g of the compound of Formula A was dissolved in mixture solvents of 250mL of methanol and 500mL of water under heating and stirring, then cooled the solution naturally to room temperature, filtered out the precipitates, got the white powder 0.42g, yield 84%.

[0202] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 7: Preparation of Form I of the compound of Formula A

[0203] 100mg of the compound of Formula A was dissolved in mixture solvents of 22mL of ethanol and 44mL of water under heating and stirring, and then cooled the solution naturally to room temperature, and the solid was collected by filtration.

[0204] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 8: Preparation of Form I of the compound of Formula A

[0205] 0.51g of the compound of Formula A was dissolved in mixture solvents of 200mL of acetonitrile and 400mL of water under heating and stirring, then cooled the solution naturally to room temperature, filtered out the precipitates, got the white powder 0.36g, yield 70%.

[0206] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 9: Preparation of Form I of the compound of Formula A

[0207] The pre-mixed solvents of acetone and tetrahydrofuran in a volume ratio of 5:1 was added gradually to a flask containing the compound of Formula A, heated it to mild reflux, stirred it, and added above mixed solvents constantly till the compound of Formula A was totally dissolved finally, then cooled the solution naturally to room temperature; the precipitated solid was collected by filtration, got the white powder. The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 10: Preparation of Form I of the compound of Formula A

[0208] The pre-mixed solvents of acetone and tetrahydrofuran in a volume ratio of 1:7 was added gradually to a flask containing the compound of Formula A, heated it to mild reflux, stirred it, and added above mixed solvents constantly till the compound of Formula A was totally dissolved finally, then cooled the solution naturally to room temperature; the precipitated solid was collected by filtration, got the white powder. The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 11: Preparation of Form I of the compound of Formula A

[0209] 50mg of the compound of Formula A was dissolved in 6mL of mixture solvents of tetrahydrofuran and acetonitrile in a volume ratio of 1:3 under heating and stirring, then stopped heating and cooled the solution naturally to room temperature, stood for crystallization; and the precipitates were collected by filtration to obtain the Form I of the compound of Formula A.

[0210] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 12: Preparation of Form I of the compound of Formula A

[0211] 200mg of the compound of Formula A was dissolved in 26mL mixture solvents of tetrahydrofuran and acetonitrile in a volume ratio of 1:7 under heating and stirring, then stopped heating and cooled the solution naturally to 25°C; then put the mixture to ultrasonic for 15minutes; after that the mixture was reheated to 60-65°C to dissolve most of the precipitates, then cooled the solution to room temperature, again reheated to 60-65°C to dissolve most of the precipitates, and then cooled the mixture to room temperature for precipitating completely; the precipitates were collected by filtration.

[0212] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 13: Preparation of Form I of the compound of Formula A

[0213] 0.5g of the compound of Formula A was dissolved in solvent mixture of 20mL dichloromethane, 5mL acetic acid and 25mL n-heptane by stirring at room temperature, continued stirring for about another 5-6hrs, the solid precipitated, and then continued stirring at 25-30°C for another 48hrs. The solid was collected by filtration, and then dried.

[0214] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 14: Preparation of Form I of the compound of Formula A

[0215] 79mg of the compound of Formula A was dissolved in 16mL of isopropanol under heating and stirring, then to the solution 20mL of water was added slowly, then cooled the solution naturally to room temperature; the precipitate was collected by filtration, and dried at 60°C under vacuum, got white powder 77.5mg, yield 98.1%. The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 15: Preparation of Form I of the compound of Formula A

[0216] 100mg of the compound of Formula A was dissolved in 10mL of dichloromethane under heating and stirring, to the solution 20mL of ethyl acetate was added slowly; the product was precipitated out by cooling the solution naturally to 40°C, then the solid was collected by filtration.

[0217] The powder X-ray diffractogram of the sample obtained by this method is the same as

that of the Form I of the compound of Formula A obtained in Example 1.

Example 16: Preparation of Form I of the compound of Formula A

[0218] Dissolved 2g of the compound of Formula A in 688mL acetone under heating and stirring, filtrated the hot solution, then to the solution 752mL of n-heptane was added slowly under refluxing and stirring, stopped heating, the solution was cooled naturally under stirring for 3-4hrs, filtered the precipitates, dried at 60°C under vacuum for 2hrs, got crystalline white solid.

[0219] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 17: Preparation of Form I of the compound of Formula A

[0220] 100mg of the compound of Formula A was dissolved in 10mL of dichloromethane under heating and stirring, to the solution was added 10mL of n-heptane slowly, the product precipitated, and was collected by filtration.

[0221] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 18: Preparation of Form I of the compound of Formula A

[0222] 0.2g of the compound of Formula A was dissolved in 20mL of DMSO under heating and stirring, then 9mL of water was added in dropwise, cooled to room temperature, and the product precipitated, and was collected by filtration.

[0223] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 19: Preparation of Form I of the compound of Formula A

[0224] 88mg of the compound of Formula A was dissolved in 2.0mL of DMF under heating and stirring, and 1.5mL of water was added to the solution slowly; then heated to get a clear solution, then cooled to room temperature for precipitation, filtered out the precipitates, dried at 60°C under vacuum, got the solid sample.

[0225] The powder X-ray diffractogram of the sample obtained by this method is the same as

that of the Form I of the compound of Formula A obtained in Example 1.

Example 20: Preparation of Form I of the compound of Formula A

[0226] 94mg of the compound of Formula A was dissolved in 35mL of acetone under heating and stirring, then to the solution was added 40mL of water slowly, then cooled the solution to room temperature for precipitation, filtered out the precipitates, dried at 60°C under vacuum overnight, got the solid sample.

[0227] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 21: Preparation of Form I of the compound of Formula A

[0228] 2.8g of the compound of Formula A was dissolved in 600mL of ethanol under heating and stirring, to the solution 1200mL of water was added slowly, maintained the solution temperature not lower than 60°C and filtered through filter paper, the filtrate was stirred at room temperature overnight for precipitation. The solid was collected by filtration, dried at 60°C under vacuum overnight, got the solid sample. The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 22: Preparation of Form I of the compound of Formula A

[0229] 111.54 mg of the compound of Formula A was suspended in 22mL of mixture solvents of acetone/water (1/1, V/V), and stirred at 60°C for 20hrs. Then stopped heating, and the solid was collected by filtration.

[0230] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 23: Preparation of Form I of the compound of Formula A

[0231] 50mg of Form I of the compound of Formula A and 2.5mg of Form II of the compound of Formula A were suspended in 5mL of mixture solvents of ethanol/water (1/3, V/V) and stirred at 60°C for 20hrs, then stopped heating, and the solid was collected by filtration.

[0232] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 24: Preparation of Form I of the compound of Formula A

[0233] 91.6mg of Form I of the compound of Formula A and 92.0mg of Form III of the compound of Formula A were suspended in 8mL of mixture solvents of ethanol/water (1/9, V/V) and stirred at 40°C overnight, then stopped heating, and the solid was collected by filtration.

[0234] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 25: Preparation of Form I of the compound of Formula A

[0235] 3.1g of mix crystalline forms of the compound of Formula A consisting of Form I and Form III was suspended in 77.5mL of acetone, heated to reflux under stirring for 16hrs; then stopped heating, and the solid was collected by filtration.

[0236] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form I of the compound of Formula A obtained in Example 1.

Example 26 (Reference): Preparation of Form II of hemiethanol solvate of the compound of Formula A

[0237] 1.0g of the compound of Formula A was dissolved in 600mL of ethanol by heating to reflux under stirring, and then cooled the solution to room temperature; and the solid was collected by filtration, dried at 55°C under vacuum for 6 hours, Form II of hemiethanol solvate of the compound of Formula A was got, m.p. (DSC): 245.7-247.0°C.

[0238] The obtained powder sample is Form II of hemiethanol solvate of the compound of Formula A, the powder X-ray diffractogram of which is shown in Figure 4, and the main data are shown in Table 2. Peaks (2θ) chosen from the figure has the following values: 4.243, 4.600, 5.172, 7.243, 8.231, 8.862, 9.259, 10.343, 11.430, 12.080, 13.165, 13.995, 14.586, 16.148, 17.113, 18.239, 18.911, 20.372, 22.087, 23.488, 24.772, and 26.176, each of the diffraction angles having an error of about ± 0.2 degrees (2θ), wherein characteristic peaks (2θ) are identified as 8.231, 10.343, 12.080, and 13.165.

[0239] DSC curve shows that the melting point range of the Form II obtained is 245.7-247.0°C as shown in Figure 5.

[0240] TGA curve shows that the Form II obtained is hemiethanol solvate as shown in Figure

6.

[0241] ^1H NMR (400 MHz, CDCl_3) δ 8.59 (s, 1H), 7.69 (d, J = 8.5 Hz, 1H), 7.56 (s, 1H), 7.38 (d, J = 2.1 Hz, 1H), 7.32 (s, 1H), 7.19 (dd, J = 8.5, 2.1 Hz, 1H), 4.06 (d, J = 3.3 Hz, 7H), 3.70 (d, J = 7.9 Hz, 1H), 3.05 (d, J = 4.9 Hz, 3H), 2.72 (s, 3H), 1.27 (s, 1H), 1.22 (t, J = 7.0 Hz, 1H).

Table 2

#	2 θ	Height	I%	Area	I%
1	4.243	4433	29.3	56888	25.6
2	4.600	1942	12.8	18713	8.4
3	5.172	1232	8.1	2410	1.1
4	7.243	1344	8.9	7622	3.4
5	8.231	11989	79.3	192553	86.6
6	8.862	2058	13.6	21656	9.7
7	9.259	3245	21.5	35380	15.9
8	10.343	7843	51.8	98631	44.3
9	11.430	2043	13.5	13764	6.2
10	12.080	13569	89.7	169759	76.3
11	13.165	15128	100.0	222476	100.0
12	14.586	7078	46.8	87027	39.1
13	18.239	5229	34.6	65146	29.3
14	18.911	2288	15.1	21311	9.6
15	20.372	2524	16.7	21225	9.5
16	22.087	2052	13.6	20523	9.2
17	23.488	2990	19.8	23463	10.5
18	26.176	2719	18.0	35243	15.8

Example 27 (Reference): Preparation of Form II of hemiethanol solvate of the compound of Formula A

[0242] 112.7mg of the compound of Formula A was dissolved in 35mL of ethanol under heating and stirring, then to the solution was added 70mL of n-heptane slowly; then cooled the solution to room temperature and stirred overnight; the solid was collected by filtration, Form II of hemiethanol solvate of the compound of Formula A was got.

[0243] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form II of hemiethanol solvate of the compound of Formula A obtained in Example 26.

Example 28 (Reference): Preparation of Form II of hemiethanol solvate of the compound of Formula A

[0244] 0.6g of the compound of Formula A was dissolved in mixture solvents of 36mL of ethanol and 12mL of acetic acid under heating and stirring, then to the solution was added 48mL of n-heptane in dropwise, cooled to room temperature and stirred for 3hrs. The solid was collected by filtration, and dried under ambient temperature. The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form II of hemiethanol solvate of the compound of Formula A obtained in Example 26.

Example 29 (Reference): Preparation of Form II of hemiethanol solvate of the compound of Formula A

[0245] 1.3g of the compound of Formula A was suspended in 450mL of mixture solvents of ethanol/tetrahydrofuran (2/1 in V/V), heated by heating to reflux to dissolve it, then cooled to 20-30°C slowly, then stirred at 20-30°C for 16hrs. The solid was collected by filtration, and dried under ambient temperature for 24hrs, then dried under vacuum at 55°C for 5hrs.

[0246] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form II of hemiethanol solvate of the compound of Formula A obtained in Example 26.

Example 30 (Reference): Preparation of Form II of hemiethanol solvate of the compound of Formula A

[0247] 1.0g of the compound of Formula A was suspended in 306mL of mixture solvents of ethanol/tetrahydrofuran (5/1 in V/V), heated by heating to reflux to dissolve it, then cooled to 20-30°C slowly, then stirred at 20-30°C for 16hrs. The solid was collected by filtration.

[0248] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form II of hemiethanol solvate of the compound of Formula A obtained in Example 26.

Example 31 (Reference): Preparation of Form II of hemiethanol solvate of the compound of Formula A

[0249] 86mg of Form IV of the compound of Formula A was suspended in 2mL of ethanol and stirred at 40°C for 3days, the solid was collected by filtration.

[0250] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form II of hemiethanol solvate of the compound of Formula A obtained in Example 26.

Example 32 (Reference): Preparation of Form II of hemiethanol solvate of the compound of Formula A

[0251] A mixture of 25mg of Form I and 25mg of Form II of the compound of Formula A was suspended in solvent mixture of 2mL n-heptane and 0.5mL ethanol, the suspension was stirred at room temperature for 3days, the solid was collected by filtration.

[0252] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form II of hemiethanol solvate of the compound of Formula A obtained in Example 26.

Example 33 (Reference): Preparation of Form II of hemiethanol solvate of the compound of Formula A

[0253] A mixture of 50mg of Form I, 50mg of Form II and 50mg of Form III of the compound of Formula A was suspended in solvent mixture of 2mL ethanol and 0.5mL water, then heated to 60°C and stirred at 60°C for 24hrs, the solid was collected by filtration. The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form II of hemiethanol solvate of the compound of Formula A obtained in Example 26.

Example 34 (Reference): Preparation of Form III of the compound of Formula A

[0254] 1.2g of the compound of Formula A was suspended in proper amount of mixture solvents of tetrahydrofuran and water (1/1, V/V), heated to reflux under stirring to dissolve the compound of Formula A, and then the solution was cooled to room temperature and stirred for 20hrs. The solid was collected by filtration, and Form III of the compound of Formula A was got, m.p. (DSC): 248.04-249.00°C.

[0255] The obtained powder sample is Form III of the compound of Formula A, the powder X-ray diffractogram of which is shown in Figure 7, and the main data are shown in Table 3. Peaks (2 θ) chosen from the figure has the following values: 4.872, 7.199, 8.619, 9.756, 10.586, 12.028, 14.415, 15.163, 16.189, 20.426, 22.357, 24.253, 24.882, 25.411, and 26.082, each of the diffraction angles having an error of about ± 0.2 degrees (2 θ), wherein characteristic peaks (2 θ) are identified as 7.199, 8.619, 14.415, and 15.163.

[0256] DSC curve shows that the melting point range of the Form III of the compound of Formula A is 248.04-249.00°C as shown in Figure 8.

Table 3

#	2θ	Height	I%	Area	I%
1	4.872	1489	9.4	17428	8.4
2	7.199	6222	39.1	81265	39.3
3	8.619	12272	77.2	173969	84.2
4	12.028	3635	22.9	44392	21.5
5	14.415	7237	45.5	104182	50.4
6	15.163	15894	100.0	206710	100.0
7	16.189	2087	13.1	23216	11.2
8	17.293	724	4.6	3832	1.9
9	19.895	1152	7.2	15781	7.6
10	20.426	2989	18.8	39459	19.1
11	22.357	3084	19.4	51058	24.7
12	23.993	1951	12.3	22113	10.7
13	24.253	1802	11.3	39616	19.2
14	24.882	1598	10.1	6668	3.2
15	25.411	2941	18.5	20619	10.0
16	26.082	4601	28.9	56578	27.4
17	29.101	2397	15.1	31862	15.4
18	32.688	1107	7.0	11840	5.7

Example 35 (Reference): Preparation of Form III of the compound of Formula A

[0257] 1.7g of the compound of Formula A was suspended in 70mL of mixture solvents of tetrahydrofuran and water (3/1, V/V), heated to reflux under stirring to dissolve the compound of Formula A, then cooled the solution to room temperature slowly, the solid was collected by filtration.

[0258] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form III of the compound of Formula A obtained in Example 34.

Example 36 (Reference): Preparation of Form III of the compound of Formula A

[0259] 1.25g of the compound of Formula A was suspended in 500mL of mixture solvents of

tetrahydrofuran and water (1/2.57, V/V), heated to reflux under stirring to dissolve the compound of Formula A, then cooled the solution to room temperature slowly, stirred at 20-30°C for 16hrs, the solid was collected by filtration.

[0260] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form III of the compound of Formula A obtained in Example 34.

Example 37 (Reference): Preparation of Form III of the compound of Formula A

[0261] 40mg of the compound of Formula A was suspended in 13mL of mixed solvents of acetonitrile and water (1/1, V/V), heated to 72°C under stirring to dissolve the compound of Formula A; then the solution was cooled to room temperature slowly, and the solid was collected by filtration.

[0262] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form III of the compound of Formula A obtained in Example 34.

Example 38 (Reference): Preparation of Form III of the compound of Formula A

[0263] 53mg of the compound of Formula A was suspended in 5.2mL of mixed solvent of acetonitrile and water (7/1, V/V), heated to 72°C under stirring to dissolve the compound of Formula A; then the solution was cooled to room temperature slowly, and the solid was collected by filtration.

[0264] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form III of the compound of Formula A obtained in Example 34.

Example 39 (Reference): Preparation of Form IV of monoacetic acid solvate of the compound of Formula A

[0265] 3.0g of the compound of Formula A was suspended in 60mL of dichloromethane and heated to reflux under stirring, then to the suspension 12mL of acetic acid was added, the suspended solid dissolved to obtain clarified solution; then 120mL of n-heptane was added by dropwise at refluxing temperature, after the addition completed, the obtained mixture was stirred under reflux for 1hr, then cooled to 20-30°C slowly; after stirred at 20-30°C for 16hrs, the solid was collected by filtration, then dried for 1 day under ambient condition, and Form IV of monoacetic acid solvate of the compound of Formula A was got, m.p. (DSC): 245.1-247.4°C.

[0266] The obtained powder sample is Form IV of monoacetic acid solvate of the compound of

Formula A, the powder X-ray diffractogram of which is shown in Figure 10, and the main data are shown in Table 4. Peaks (2θ) chosen from the figure has the following values: 5.724, 7.601, 10.071, 10.501, 11.488, 13.322, 15.358, 16.305, 17.331, 18.098, 20.152, 21.202, 22.720, 26.373, and 26.865, each of the diffraction angles having an error of about ± 0.2 degrees (2θ), wherein characteristic peaks (2θ) are identified as 5.724, 7.601, 10.501, and 11.488.

[0267] DSC curve shows that the melting point range of the Form IV of monoacetic acid solvate of the compound of Formula A is 245.1-247.4°C as shown in Figure 11. TGA curve shows that the Form IV obtained is monoacetic acid solvate as shown in Figure 12.

[0268] ^1H NMR (400 MHz, CDCl_3) δ 8.60 (s, 1H), 7.70 (d, $J = 8.5$ Hz, 1H), 7.57 (s, 1H), 7.39 (d, $J = 2.0$ Hz, 1H), 7.37 (s, 1H), 7.20 (dd, $J = 8.5, 2.1$ Hz, 1H), 4.07 (d, $J = 2.1$ Hz, 7H), 3.06 (d, $J = 4.9$ Hz, 3H), 2.73 (s, 3H), 2.08 (s, 3H).

Table 4

#	2θ	Height	I%	Area	I%
1	5.724	12068	62.6	176947	75.7
2	7.601	8273	42.9	109210	46.7
3	10.071	7520	39.0	106430	45.5
4	10.501	15789	81.8	189592	81.1
5	11.488	19293	100.0	233846	100.0
6	13.322	2388	12.4	23998	10.3
7	15.358	6048	31.3	69472	29.7
8	16.305	844	4.4	2365	1.0
9	17.331	4993	25.9	52614	22.5
10	18.098	1214	6.3	4800	2.1
11	20.152	4433	23.0	42594	18.2
12	21.202	2314	12.0	17590	7.5
13	22.088	1310	6.8	5597	2.4
14	22.720	2829	14.7	26114	11.2
15	26.373	1600	8.3	8644	3.7
16	26.865	1668	8.6	11143	4.8
17	29.685	1231	6.4	6018	2.6
18	31.029	1092	5.7	4810	2.1
19	31.974	963	5.0	3321	1.4
20	32.944	1196	6.2	10222	4.4

Example 40 (Reference): Preparation of Form IV of monoacetic acid solvate of the

compound of Formula A

[0269] 0.5g of the compound of Formula A was suspended in mixture solvents of 10mL of dichloromethane and 2mL of acetic acid, heated to reflux under stirring to dissolve it, then 20mL of n-heptane was added to the refluxing solution, the solution was continue to reflux for 5hrs; huge amount of solid was precipitated, the suspension was cooled to 20-30°C slowly and continued stirring for another 18hrs, and the solid was collected by filtration.

[0270] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form IV of monoacetic acid solvate of the compound of Formula A obtained in Example 39.

Example 41 (Reference): Preparation of Form IV of monoacetic acid solvate of the compound of Formula A

[0271] 0.5g of the compound of Formula A was suspended in 10mL of acetic acid, heated to 90°C under stirring to dissolve it, then 20mL of n-heptane was added to the solution; the solution was continue stirring at 90°C for another 1hr, then cooled to 20-30°C slowly, huge amount of solid was precipitated, after that heated to 90°C and stirred for 2hrs, then cooled to 20-30°C and stirred at that temperature for 18hrs, the solid was collected by filtration.

[0272] The powder X-ray diffractogram of the sample obtained by this method is the same as that of the Form IV of monoacetic acid solvate of the compound of Formula A obtained in Example 39.

Example 42 (Reference): Preparation of Form VII of the compound of Formula A

[0273] 2.0g of the compound of Formula A was suspended in 180mL of mixture solvents of THF/H₂O (1/1, V/V), heated under stirring to dissolve it; then the solution was cooled to ambient temperature slowly, and the solid was collected by filtration, dried at ambient temperature for 3days, then under vacuum at 55°C for 16hrs, and Form VII of the compound of Formula A was got, m.p. (DSC): 245.4-247.8°C.

[0274] The obtained powder sample is Form VII of the compound of Formula A, the powder X-ray diffractogram of which is shown in Figure 13, and the main data are shown in Table 5. Peaks (2θ) chosen from the figure has the following values: 5.883, 6.751, 7.145, 8.981, 11.784, 13.620, 14.942, 18.160, 21.356, 23.687, 27.476, 28.129, and 29.077, each of the diffraction angles having an error of about ± 0.2 degrees (2θ), wherein characteristic peaks (2θ) are identified as 8.981, 11.784, and 13.620.

[0275] DSC curve shows that the melting point range of the Form VII of the compound of Formula A is 245.4-247.8°C as shown in Figure 14.

Table 5

#	2θ	Height	I%	Area	I%
1	5.883	1668	2.5	3924	0.3
2	6.751	2855	4.2	46239	3.9
3	7.145	1776	2.6	15044	1.3
4	8.981	17600	25.9	339184	28.8
5	11.784	9042	13.3	124406	10.6
6	13.620	68003	100.0	1178676	100.0
7	14.942	6867	10.1	132891	11.3
9	18.160	5657	8.3	89446	7.6
10	19.087	1581	2.3	10973	0.9
11	19.719	1088	1.6	1398	0.1
12	21.356	3021	4.4	28801	2.4
14	23.687	4944	7.3	110027	9.3
15	26.037	2416	3.6	24436	2.1
16	27.476	2684	3.9	47713	4.0
17	28.129	2525	3.7	17520	1.5
18	29.077	1528	2.2	8260	0.7
19	29.962	1516	2.2	9989	0.8

Example 43 (Reference): Preparation of Form VIII of monodioxane solvate of the compound of Formula A

[0276] 1.2g of the compound of Formula A was suspended in 100mL of dioxane, heated under stirring to dissolve it, then the solution was cooled to room temperature slowly; and the solid was collected by filtration, dried at room temperature for 2 days, and Form VIII of monodioxane solvate of the compound of Formula A was got, m.p. (DSC): 245.6-248.3°C.

[0277] The obtained powder sample is Form VIII of monodioxane solvate of the compound of Formula A, the powder X-ray diffractogram of which is shown in Figure 16, and the main data are shown in Table 6. Peaks (2θ) chosen from the figure has the following values: 5.723, 8.151, 9.040, 14.507, 16.304, 16.797, 17.923, 21.894, 22.859, 23.744, 24.535, 25.897, 29.154, and 29.846, each of the diffraction angles having an error of about ± 0.2 degrees (2θ), wherein characteristic peaks (2θ) are identified as 9.040, 14.507, 16.304, and 16.797.

[0278] DSC curve shows that the melting point range of the Form VIII of monodioxane solvate of the compound of Formula A is 245.6-248.3°C as shown in Figure 17. TGA curve shows that the Form VIII obtained is monodioxane solvate as shown in Figure 18.

[0279] ^1H NMR (400 MHz, CDCl_3) δ 8.60 (s, 1H), 7.70 (d, $J = 8.5$ Hz, 1H), 7.57 (s, 1H), 7.39 (s, 1H), 7.32 (s, 1H), 7.20 (d, $J = 8.5$ Hz, 1H), 4.06 (s, 7H), 3.69 (s, 6H), 3.06 (d, $J = 4.9$ Hz, 3H), 2.73 (s, 3H).

Table 6

#	2 θ	Height	I%	Area	I%
1	5.723	3053	7.6	38921	6.1
2	8.151	10273	25.5	140952	22.2
3	9.040	40245	100.0	635118	100.0
4	11.408	1733	4.3	14192	2.2
5	12.671	1566	3.9	18587	2.9
6	14.507	18594	46.2	302955	47.7
7	16.304	28034	69.7	463416	73.0
8	16.797	22288	55.4	404179	63.6
9	17.923	2176	5.4	16686	2.6
10	20.330	1949	4.8	24582	3.9
11	21.576	1913	4.8	3676	0.6
12	21.894	2654	6.6	18101	2.9
13	22.859	5853	14.5	67737	10.7
14	23.744	2354	5.8	18622	2.9
15	24.535	2654	6.6	27094	4.3
16	25.897	5589	13.9	96150	15.1
17	29.154	3060	7.6	38451	6.1
18	29.846	2765	6.9	26744	4.2
19	33.913	1172	2.9	7284	1.1
20	37.442	1026	2.5	7913	1.2

Example 44: Stability of Form I under high temperature, high humidity and illumination conditions:

[0280] Determination method: the test sample of Form I prepared in Example 1 was added to a culture dish, which was uncovered and put in a sealed clean container; then the container was placed under the conditions of the temperature of 60°C, the temperature of 25°C and the

relative humidity of 92.5%±5%, and the illumination of 4500lx±500lx respectively for 10 days; then sampled, investigated the purity and crystalline form of the sample, and compared the results of the investigation, which were shown in the following table.

Results of Influence factor experiment of Form I (10 days)

0 day		60°C		92.5±5% RH		4500lx±500lx	
Form	Purity A%	Form	Purity A%	Form	Purity A%	Form	Purity A%
I	98.94	I	98.90	I	98.00	I	98.66

[0281] Conclusion: the data in the table illustrate that, the chemical purity and crystalline form of the Form I are not changed after placed under high temperature, high humidity and illumination conditions for 10 days, the Form I is stable.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- [WO2009137797A2](#) [0005] [0185]
- [CN101575333A](#) [0005]

Non-patent literature cited in the description

- RUBIN M. TUDER*Chest*, 2000, vol. 117, 281- [0002]
- J. BERNSTEIN*Polymorphism in Molecular Crystals*Oxford University Press20020000 [0003]

Patentkrav

1. Form I af 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamid,
5 hvor røntgenpulverdiffraktogrammet af form I omfatter diffraktionsvinkler udtrykt i grader 2-theta (2θ) ved: 5,3, 10,7, 13,9 og 14,6, idet hver af diffraktionsvinklerne har en fejl på ca. $\pm 0,2$ grader (2θ).
- 10 2. Form I ifølge krav 1, hvor røntgenpulverdiffraktogrammet af form I omfatter diffraktionsvinkler udtrykt i grader 2-theta (2θ) ved: 5,3, 7,3, 10,7, 13,9, 14,6 og 19,9, idet hver af diffraktionsvinklerne har en fejl på ca. $\pm 0,2$ grader (2θ).
- 15 3. Form I ifølge krav 1, hvor røntgenpulverdiffraktogrammet af form I omfatter diffraktionsvinkler udtrykt i grader 2-theta (2θ) ved: 5,3, 7,3, 10,7, 13,9, 14,6, 16,3 og 19,9, idet hver af diffraktionsvinklerne har en fejl på ca. $\pm 0,2$ grader (2θ).
- 20 4. Form I ifølge krav 1, hvor røntgenpulverdiffraktogrammet af form I omfatter diffraktionsvinkler udtrykt i grader 2-theta (2θ) ved: 5,3, 7,3, 10,7, 13,9, 14,6, 16,3, 19,9, 21,1, 21,3 og 25,8, idet hver af diffraktionsvinklerne har en fejl
25 på ca. $\pm 0,2$ grader (2θ).
5. Form I ifølge krav 1, hvor røntgenpulverdiffraktogrammet af form I omfatter diffraktionsvinkler udtrykt i grader 2-theta (2θ) ved: 5,3, 7,3, 10,7, 13,9, 14,6, 15,2, 16,3, 19,9,
30 21,1, 21,3, 23,1, 23,3 og 25,8, idet hver af diffraktionsvinklerne har en fejl på ca. $\pm 0,2$ grader (2θ).
6. Form I ifølge krav 1, hvor form I kan have et røntgenpulverdiffraktogram som vist i figur 1, idet hver af
35 diffraktionsvinklerne har en fejl på ca. $\pm 0,2$ grader (2θ).
7. Form I ifølge et hvilket som helst af kravene 1 til 6, hvor indholdet af andre krystalformer af 6-((6,7-

dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamid er mindre end 40 vægt-%, fortrinsvis mindre end 30 vægt-%, mere fortrinsvis mindre end 20 vægt-%, mere fortrinsvis mindre end 10 vægt-%, mere fortrinsvis mindre end 5 vægt-% eller endnu mere fortrinsvis mindre end 1 vægt-%.

8. Farmaceutisk sammensætning, der omfatter en effektiv mængde af form I ifølge et hvilket som helst af kravene 1 til 7 og mindst ét farmaceutisk acceptabelt bæremateriale.

10

9. Farmaceutisk sammensætning ifølge krav 8, der yderligere omfatter en eller flere andre aktive bestanddele; hvor den ene eller de flere andre aktive bestanddele fortrinsvis er valgt blandt antineoplastiske midler;

15 mere fortrinsvis hvor den ene eller de flere andre aktive bestanddele er valgt blandt DNA-beskadigende kemoterapeutiske midler, topoisomerase-I-inhibitorer, irinotecan, topotecan, camptothecin, doxorubicin, topoisomerase-II-inhibitorer, etoposid, teniposid, daunorubicin, alkyleringsmidler, 20 melphalan, chlorambucil, busulfan, thiotepa, ifosfamid, carmustin, lomustin, semustin, streptozocin, decarbazin, methotrexat, mitomycin C, cyclophosphamid, DNA-interkalatorer, cisplatin, oxaliplatin, carboplatin, DNA-interkalatorer og generatorer af frie radikaler, bleomycin, nukleosidmimetika, 25 5-fluorouracil, capecitabin, gemcitabin, fludarabin, cytarabin, mercaptopurin, thioguanin, pentostatin, hydroxyurinstof, kemoterapeutiske midler, der ødelægger cellereplikation, paclitaxel, docetaxel, vincristin, vinblastin, thalidomid, CC-5013, CC-4047, inhibitorer af 30 proteintyrosinkinase, imatinibmesylat, gefitinib, proteasominhibitorer, bortezomib, NF-kappa-B-inhibitorer, inhibitorer af I-kappa-B-kinase, antistoffer, der binder til proteiner, der overudtrykkes ved cancer, og derved nedregulerer cellereplikation, rituximab, cetuximab og 35 bevacizumab.

10. Form I ifølge et hvilket som helst af kravene 1 til 7 eller farmaceutisk sammensætning ifølge krav 8 eller 9 til

anvendelse til behandling af en sygdom, der er forbundet med KDR-inhibering.

11. Form I ifølge et hvilket som helst af kravene 1 til 7 eller farmaceutisk sammensætning ifølge krav 8 eller 9 til anvendelse til behandling af en angiogenese-relateret forstyrrelse, hvor den angiogenese-relaterede forstyrrelse fortrinsvis er valgt blandt cancer, aldersrelateret makuladegeneration og kronisk inflammationssygdom.

12. Form I ifølge et hvilket som helst af kravene 1 til 7 eller farmaceutisk sammensætning ifølge krav 8 eller 9 til anvendelse til behandling af cancer, som er valgt blandt luncancer, hoved- og halscancer, colorektal cancer, pankreascancer, coloncancer, brystcancer, ovariecancer, prostatacancer, ventrikelcancer, nyrecancer, levercancer, hjernecancer, knoglecancer, sarkom og leukæmi, fortrinsvis hvor canceren er colorektal cancer, luncancer, ventrikelcancer eller nyrecancer.

13. Form I ifølge et hvilket som helst af kravene 1 til 7 til anvendelse til behandling af cancer, hvor form I er til administration i kombination med en eller flere andre aktive bestanddele, hvor form I og den ene eller de flere andre aktive bestanddele er formuleret som separate sammensætninger eller er formuleret i den samme farmaceutiske sammensætning, hvor den ene eller de flere andre aktive bestanddele fortrinsvis er valgt blandt antineoplastiske midler, mere fortrinsvis blandt DNA-beskadigende kemoterapeutiske midler, topoisomerase-I-inhibitorer, irinotecan, topotecan, camptothecin, doxorubicin, topoisomerase-II-inhibitorer, etoposid, teniposid, daunorubicin, alkyleringsmidler, melphalan, chlorambucil, busulfan, thiotepa, ifosfamid, carmustin, lomustin, semustin, streptozocin, decarbazin, methotrexat, mitomycin C, cyclophosphamid, DNA-interkalatorer, cisplatin, oxaliplatin, carboplatin, DNA-interkalatorer og generatorer af frie radikaler, bleomycin, nukleosidmimetika,

5-fluorouracil, capecitabin, gemcitabin, fludarabin, cytarabin, mercaptopurin, thioguanin, pentostatin, hydroxyurinstof, kemoterapeutiske midler, der ødelægger cellereplikation, paclitaxel, docetaxel, vincristin, vinblastin, thalidomid, CC-5013, CC-4047, inhibitorer af proteintyrosinkinase, imatinibmesylat, gefitinib, proteasominhibitorer, bortezomib, NF-kappa-B-inhibitorer, inhibitorer af I-kappa-B-kinase, antistoffer, der binder til proteiner, der overudtrykkes ved cancer, og derved nedregulerer cellereplikation, rituximab, cetuximab og bevacizumab, hvor canceren fortrinsvis er valgt blandt lungecancer, hoved- og halscancer, colorektal cancer, pankreascancer, coloncancer, brystcancer, ovariecancer, prostatacancer, ventrikelcancer, nyrecancer, levercancer, hjernecancer, knoglecancer, sarkom og leukæmi, mere fortrinsvis hvor canceren er valgt blandt colorektal cancer, lungecancer, ventrikelcancer eller nyrecancer.

20 14. Fremgangsmåde, som er:

(i) en fremgangsmåde til fremstilling af form I ifølge et hvilket som helst af kravene 1 til 7, som omfatter:

(1) blanding af forbindelsen 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamid med mindst ét opløsningsmiddel eller én opløsningsmiddelblanding og opvarmning af blandingen med tilbagesvaling til opnåelse af en opløsning;

hvor det mindst ene opløsningsmiddel er valgt blandt methanol, C₃₋₆alkanol, eddikesyre og et aprotisk opløsningsmiddel; og opløsningsmiddelblanding er valgt blandt en blanding af to eller flere aprotiske opløsningsmidler eller en blanding af vand-blandbart organisk opløsningsmiddel og vand, hvori volumenprocenten af det vand-blandbare organiske opløsningsmiddel i opløsningsmiddelblanding er mindre end ca. 50 %;

(2) langsom nedkøling af opløsningen opnået i trin (1) til omgivelsestemperatur; efterfølgende

(3) isolering til opnåelse af faststoffet af form I af 6-

((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamid;

(4) tørring af faststoffet opnået i trin (3); eller

(ii) en fremgangsmåde til fremstilling af form I ifølge et
5 hvilket som helst af kravene 1 til 7, som omfatter:

(1) blanding af forbindelsen 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamid med mindst ét opløsningsmiddel, efterfølgende opvarmning af blandingen med tilbagesvaling til opnåelse af den første opløsning; hvor
10 opløsningsmidlet er valgt blandt ethanol, isopropanol, acetone, dichlormethan, dimethylsulfoxid og N,N-dimethylformamid;

(2) tilsætning af mindst ét anti-opløsningsmiddel til den første opløsning til opnåelse af den anden opløsning;

15 (3) muliggørelse af spontan langsom nedkøling af den anden opløsning til omgivelsestemperatur; efterfølgende

(4) isolering til opnåelse af faststoffet af form I af 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamid;

20 (5) tørring af faststoffet opnået i trin (4); eller

(iii) en fremgangsmåde til fremstilling af form I ifølge et hvilket som helst af kravene 1 til 7, som omfatter:

(1) suspendering af faststoffet af forbindelsen 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamid i en passende mængde af et opløsningsmiddelsystem; hvor opløsningsmiddelsystemet er valgt blandt opløsningsmiddel eller en opløsningsmiddelblanding af vand-blandbart organisk opløsningsmiddel og vand, hvori volumenprocenten af vand-blandbart organisk opløsningsmiddel i
25 opløsningsmiddelblandingen er mindre end ca. 80 %;

(2) omrøring af suspensionen opnået i trin (1) i et tidsrum;

(3) isolering til opnåelse af faststoffet af form I af 6-((6,7-dimethoxyquinazolin-4-yl)oxy)-N,2-dimethylbenzofuran-3-carboxamid;

35 (4) tørring af faststoffet opnået i trin (3).

15. Fremgangsmåde ifølge krav 14, hvor opløsningsmidlet, der anvendes i trin (1) af fremgangsmåde (iii), er acetone.

DRAWINGS

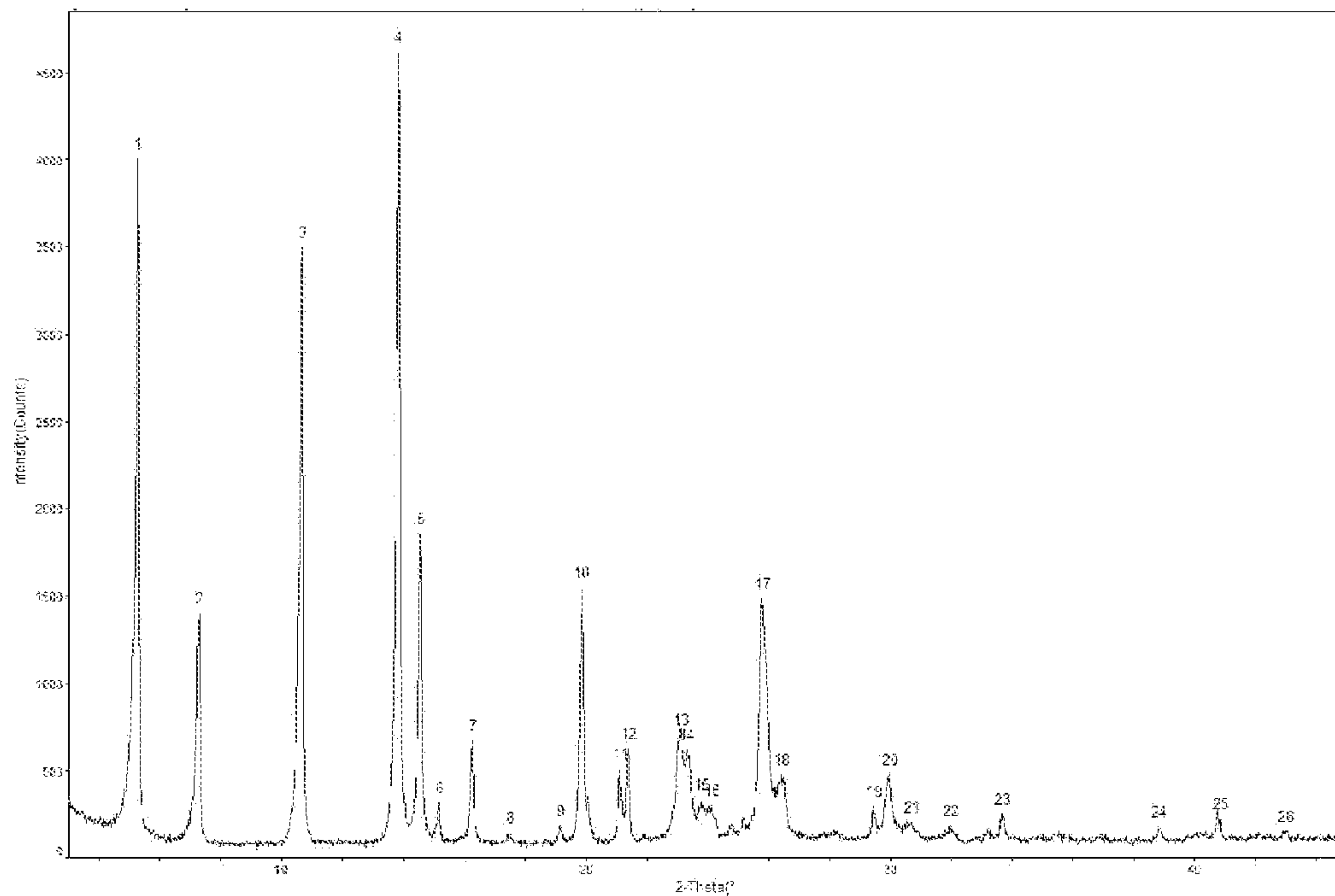


Figure 1 Powder X-ray diffractogram of Form I

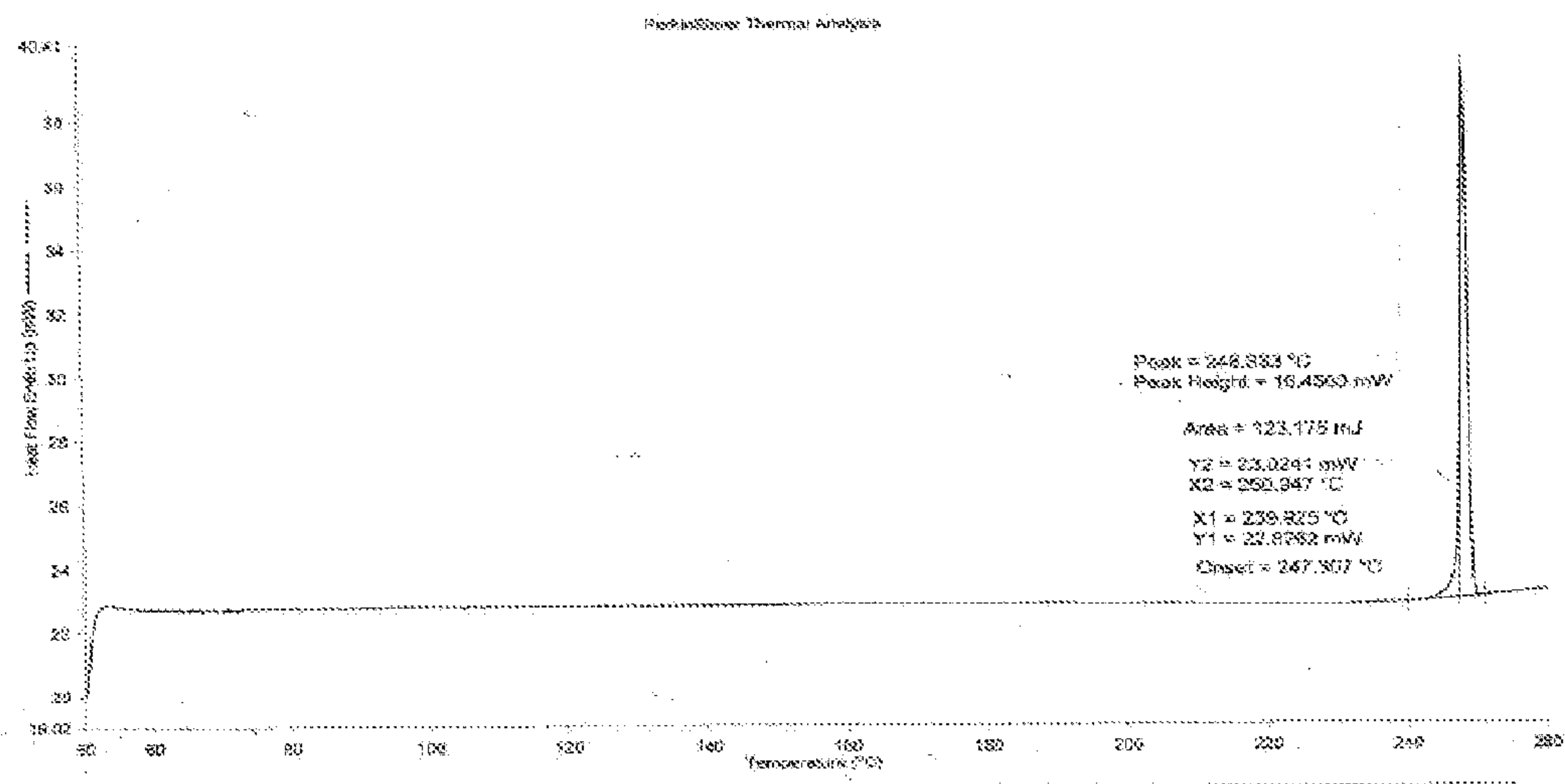


Figure 2 Differential scanning calorimeter (DSC) thermogram of Form I

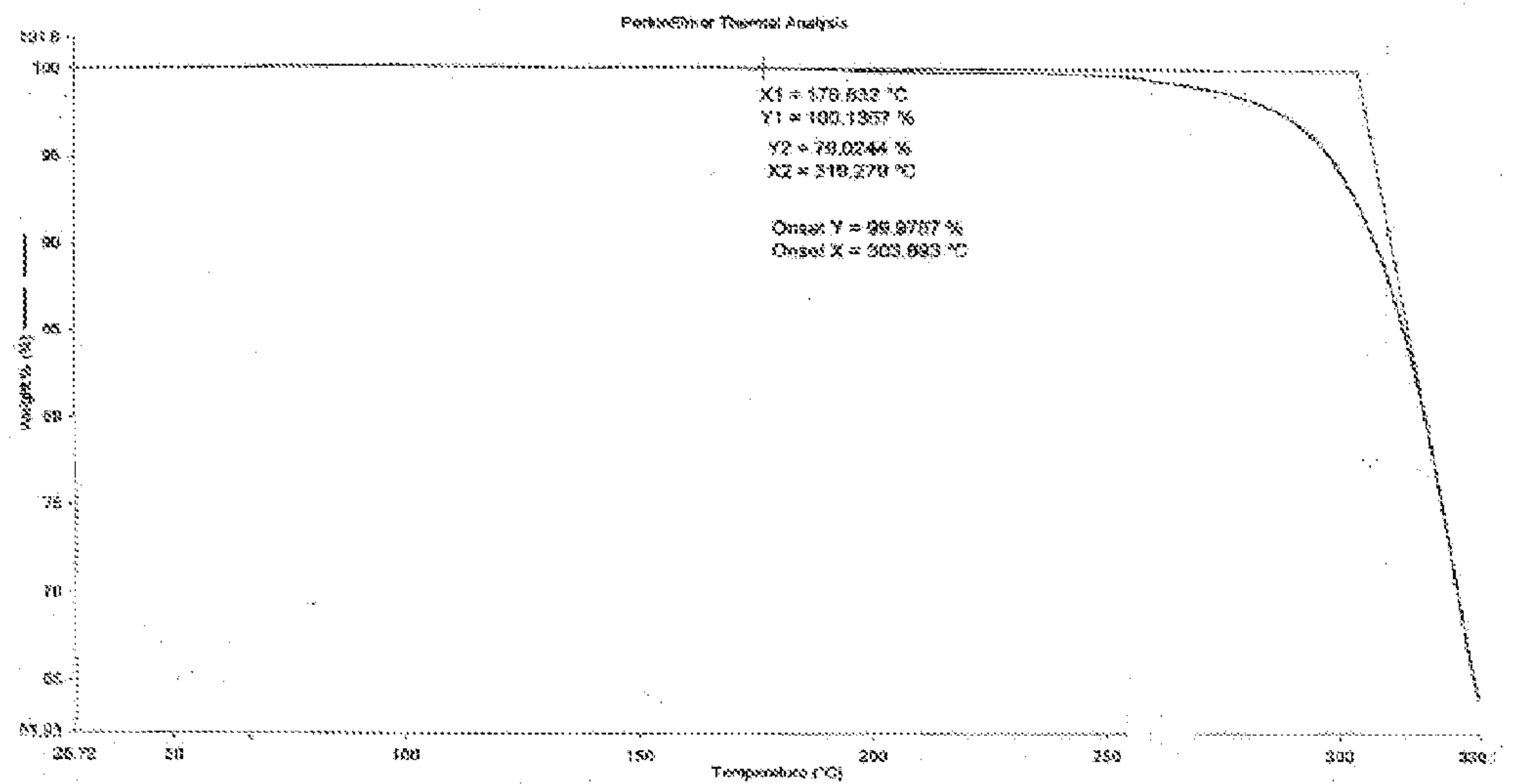


Figure 3 Thermogravimetric (TG) curve of Form I

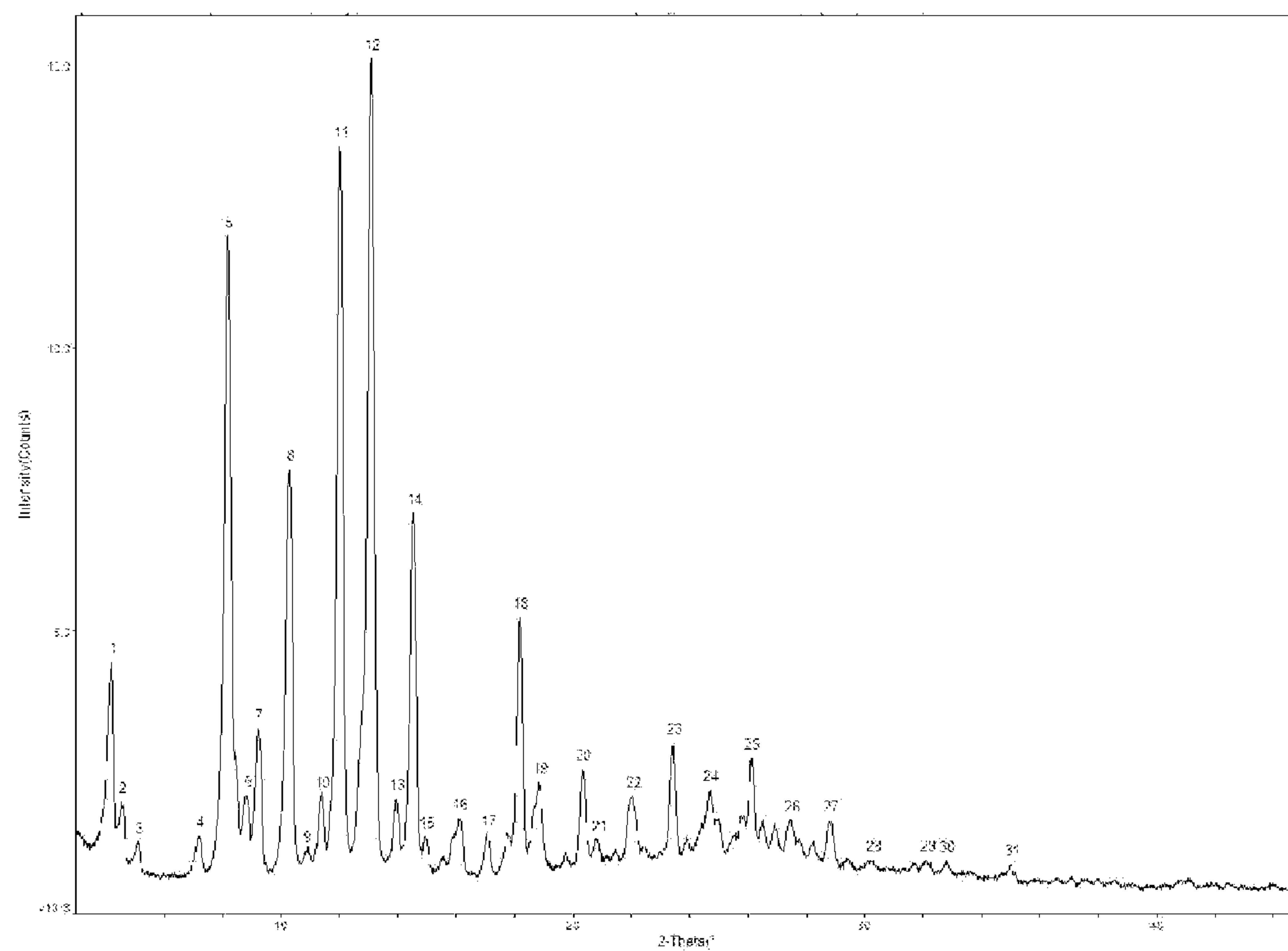


Figure 4 Powder X-ray diffractogram of Form II

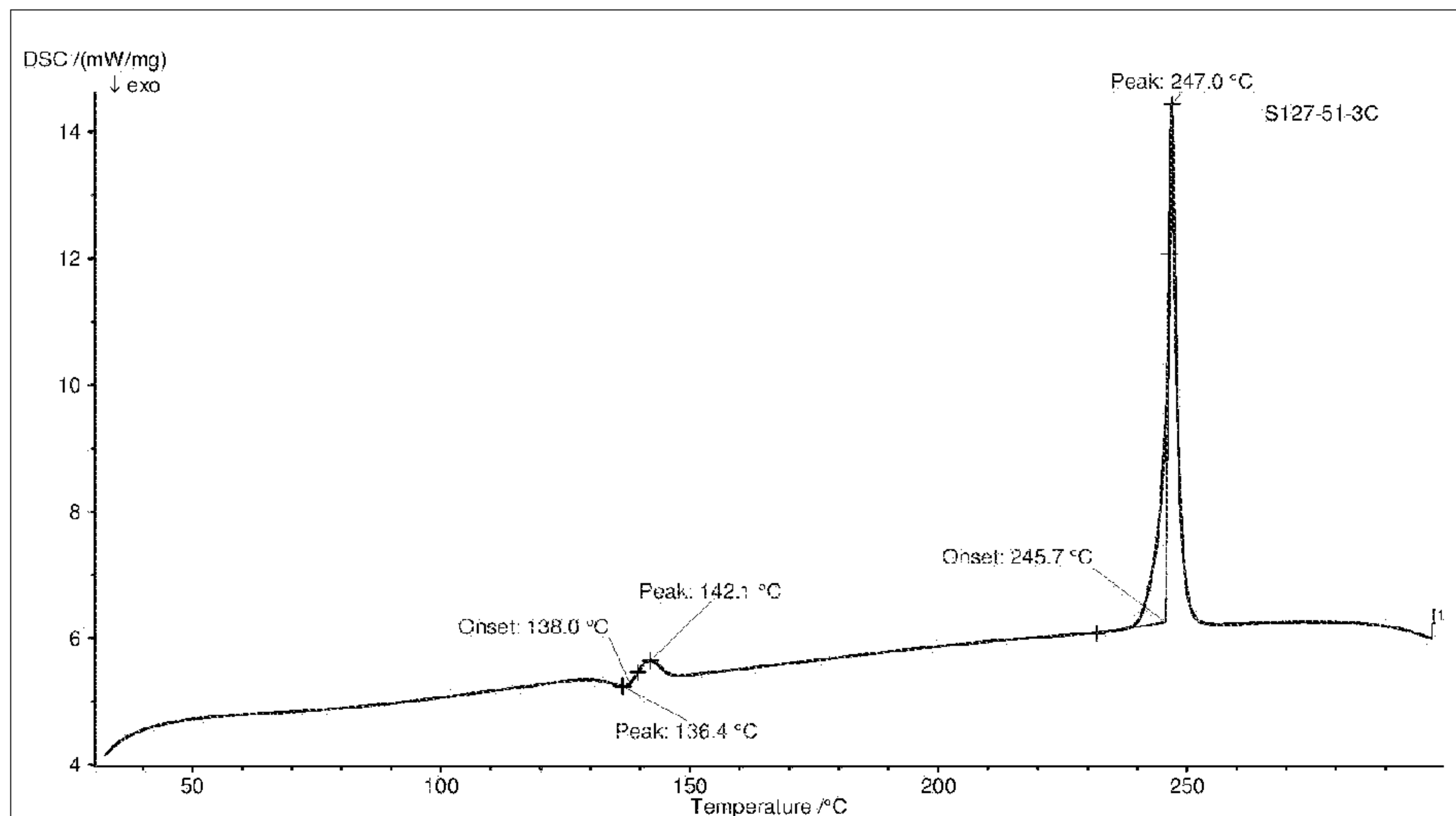


Figure 5 Differential scanning calorimeter (DSC) thermogram of Form II

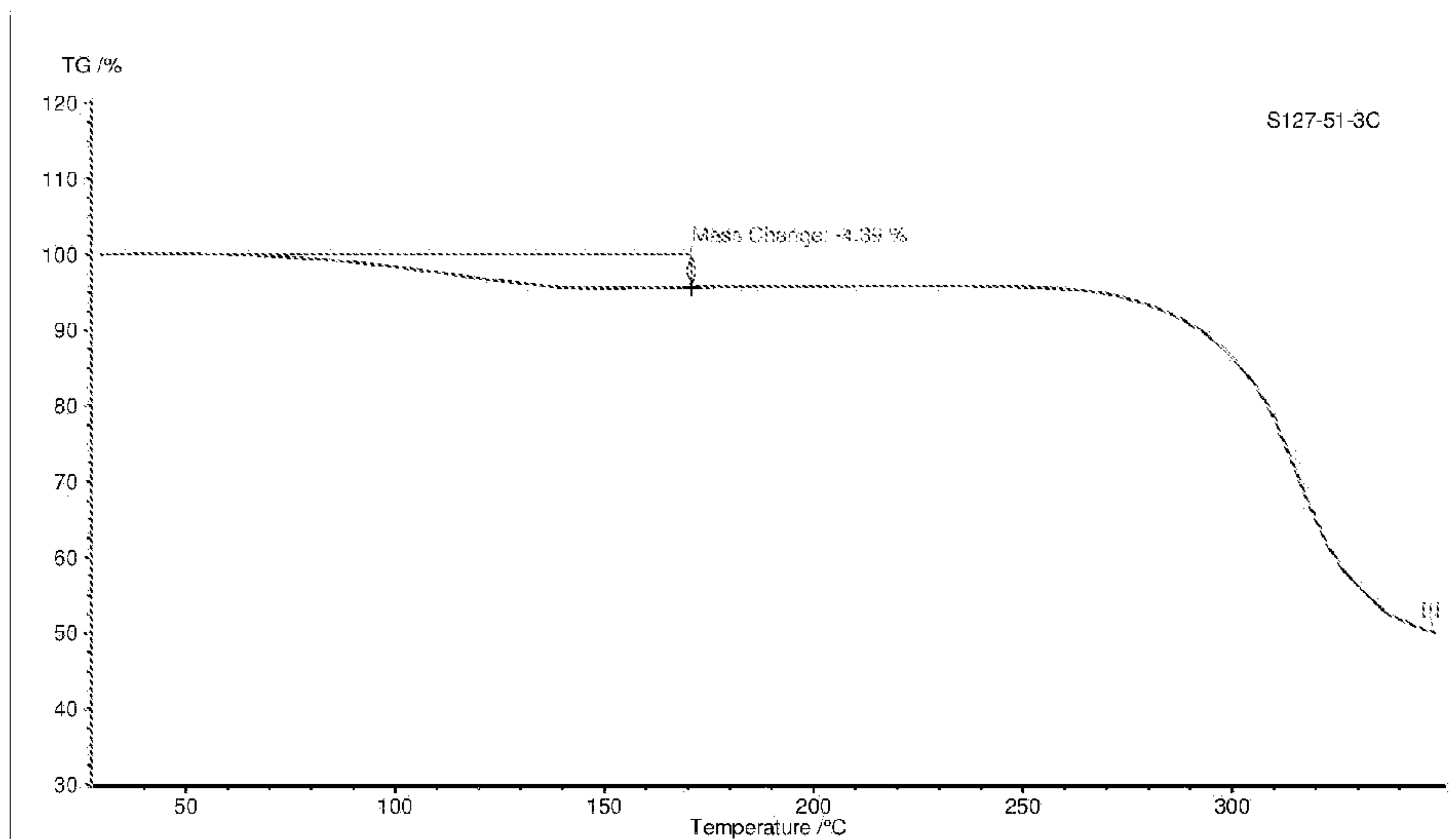


Figure 6 Thermogravimetric (TG) curve of Form II

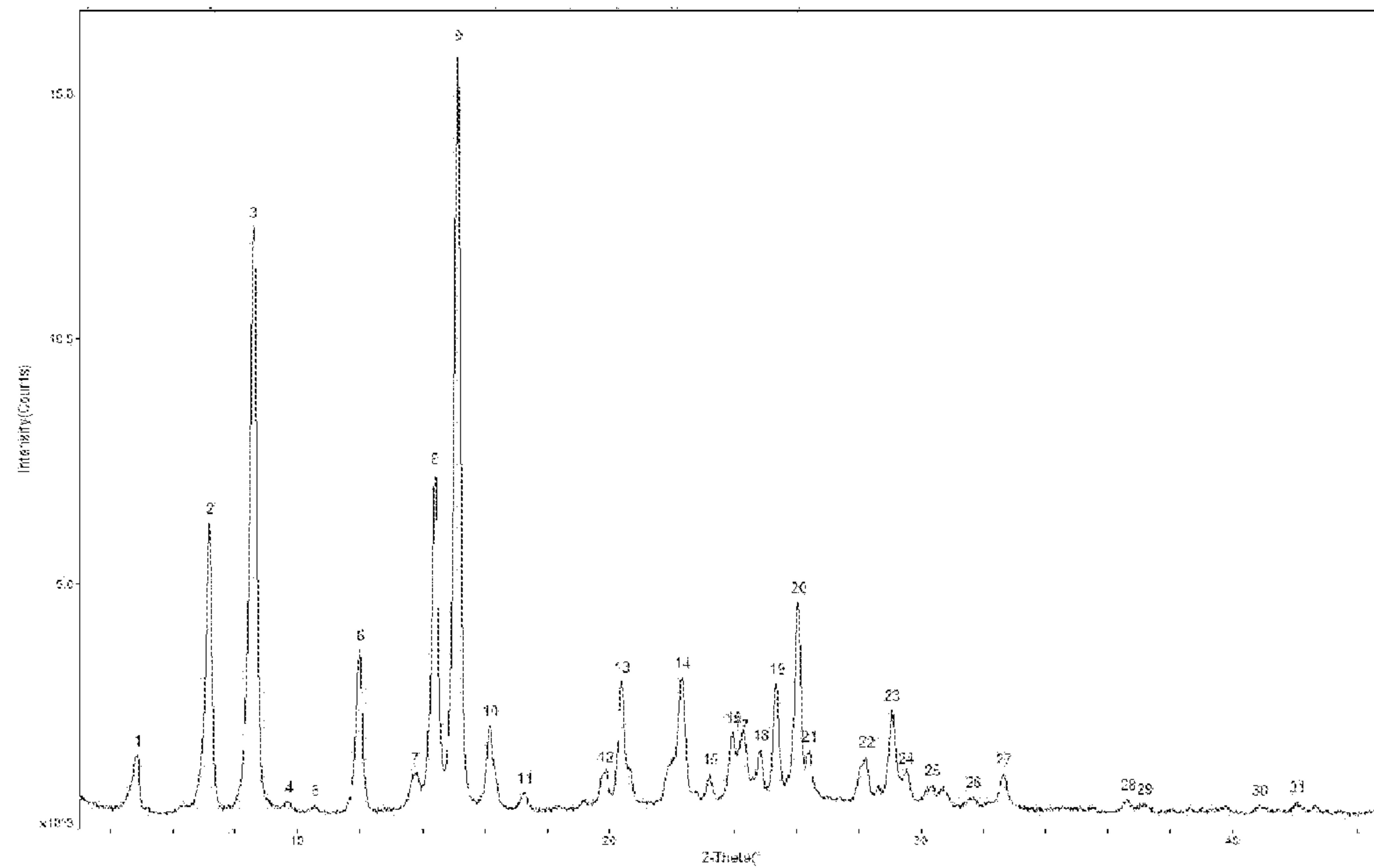


Figure 7 Powder X-ray diffractogram of Form III

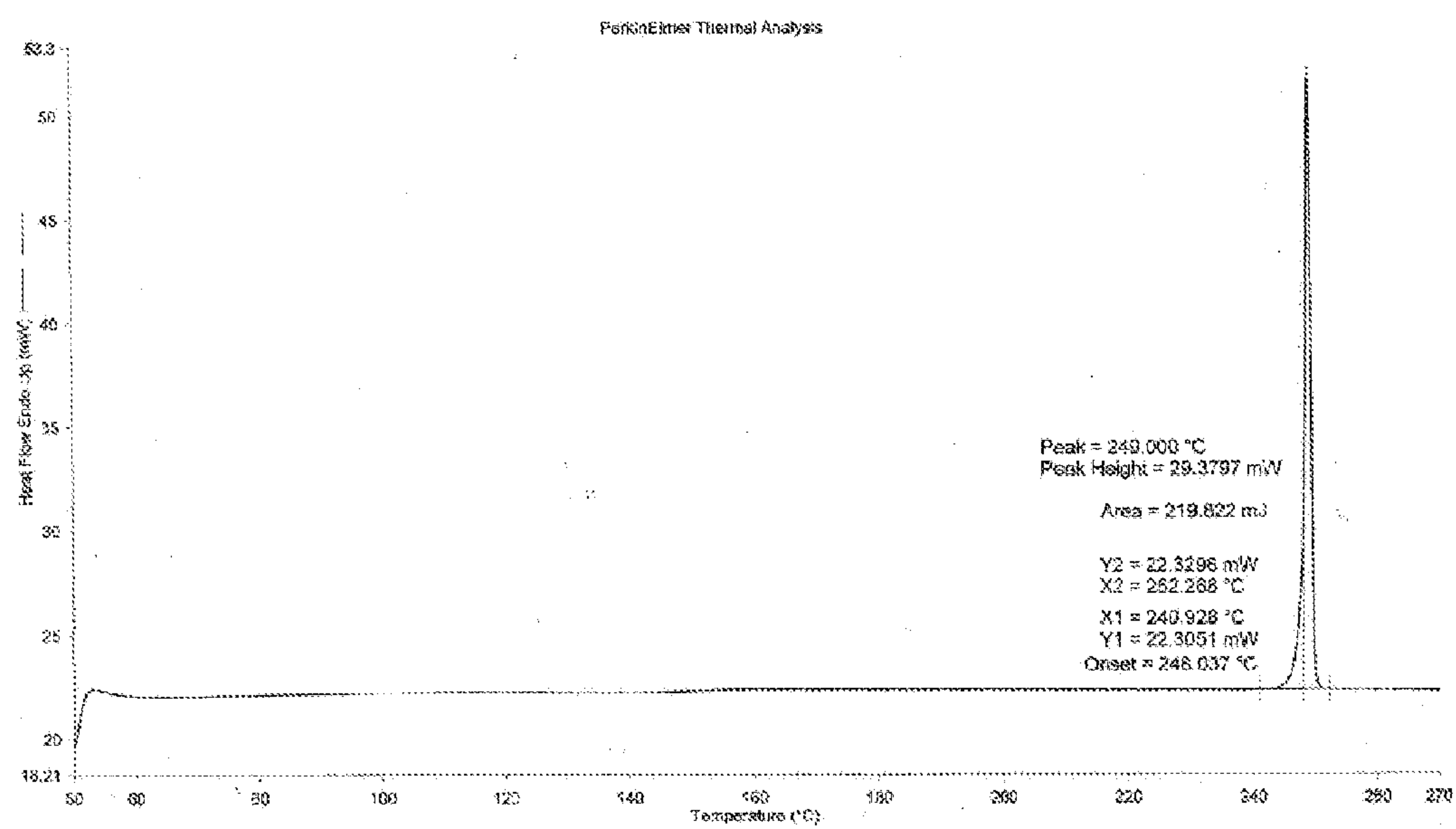


Figure 8 Differential scanning calorimeter (DSC) thermogram of Form III

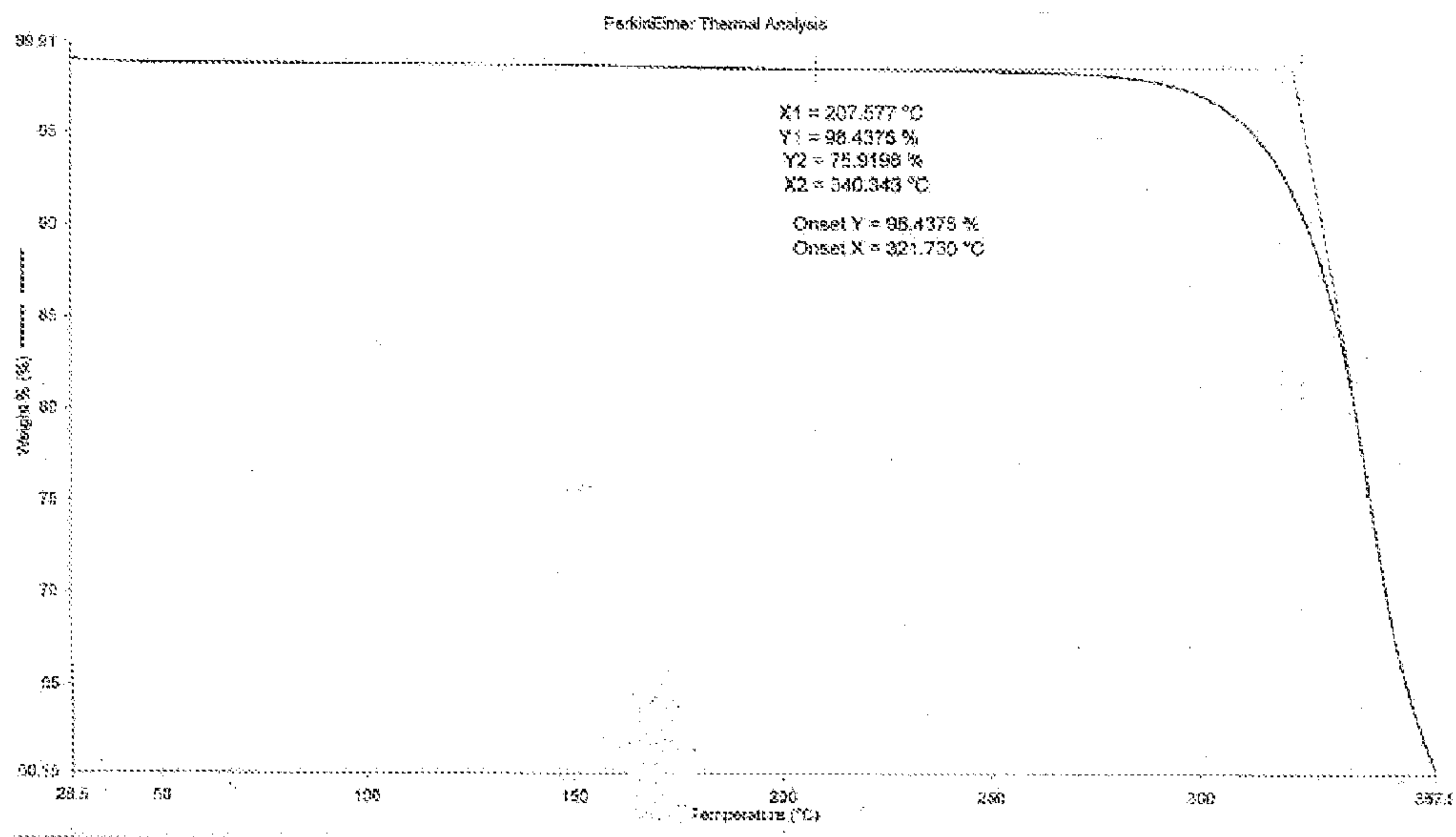


Figure 9 Thermogravimetric (TG) curve of Form III

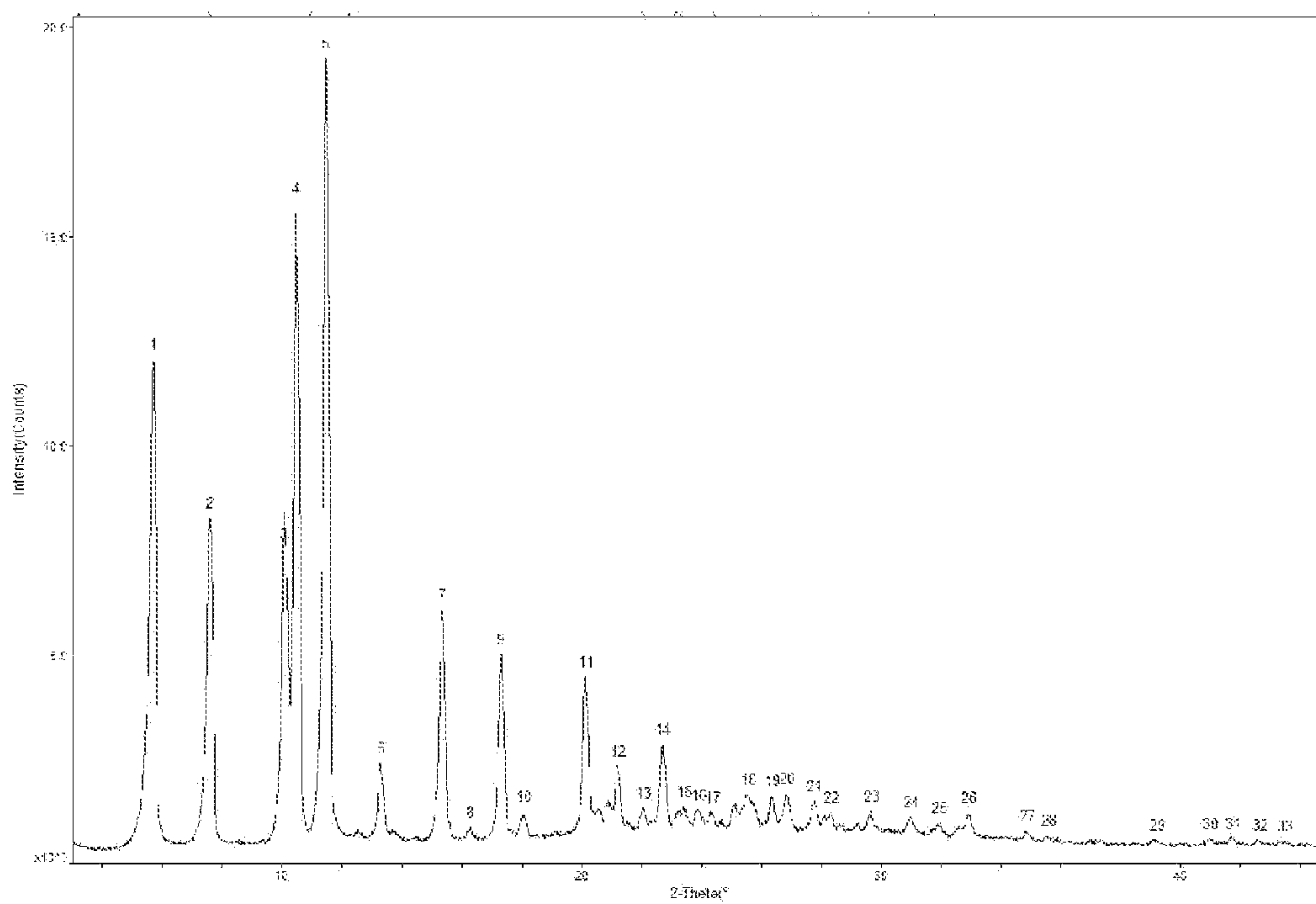


Figure 10 Powder X-ray diffractogram of Form IV

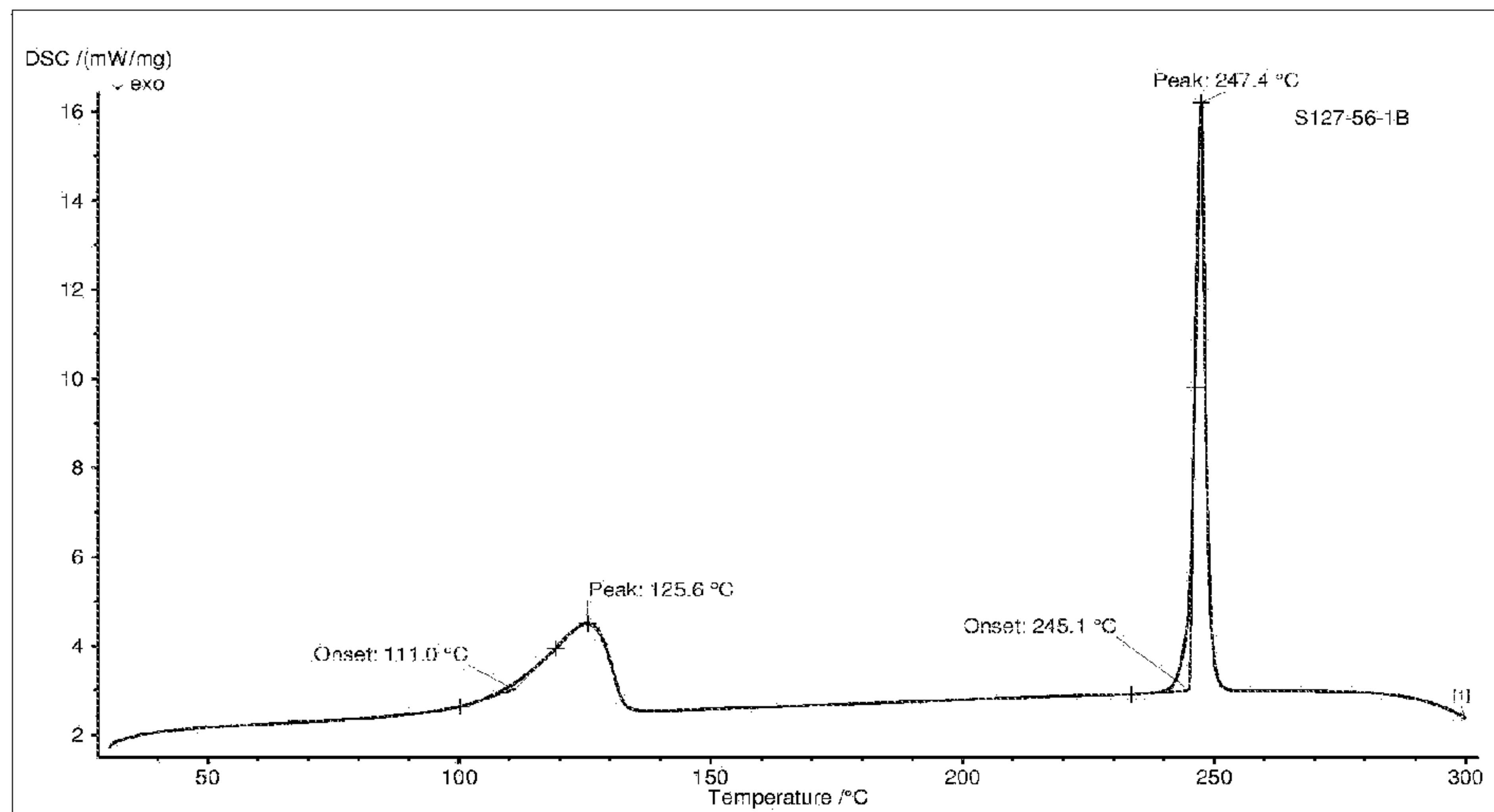


Figure 11 Differential scanning calorimeter (DSC) thermogram of Form IV

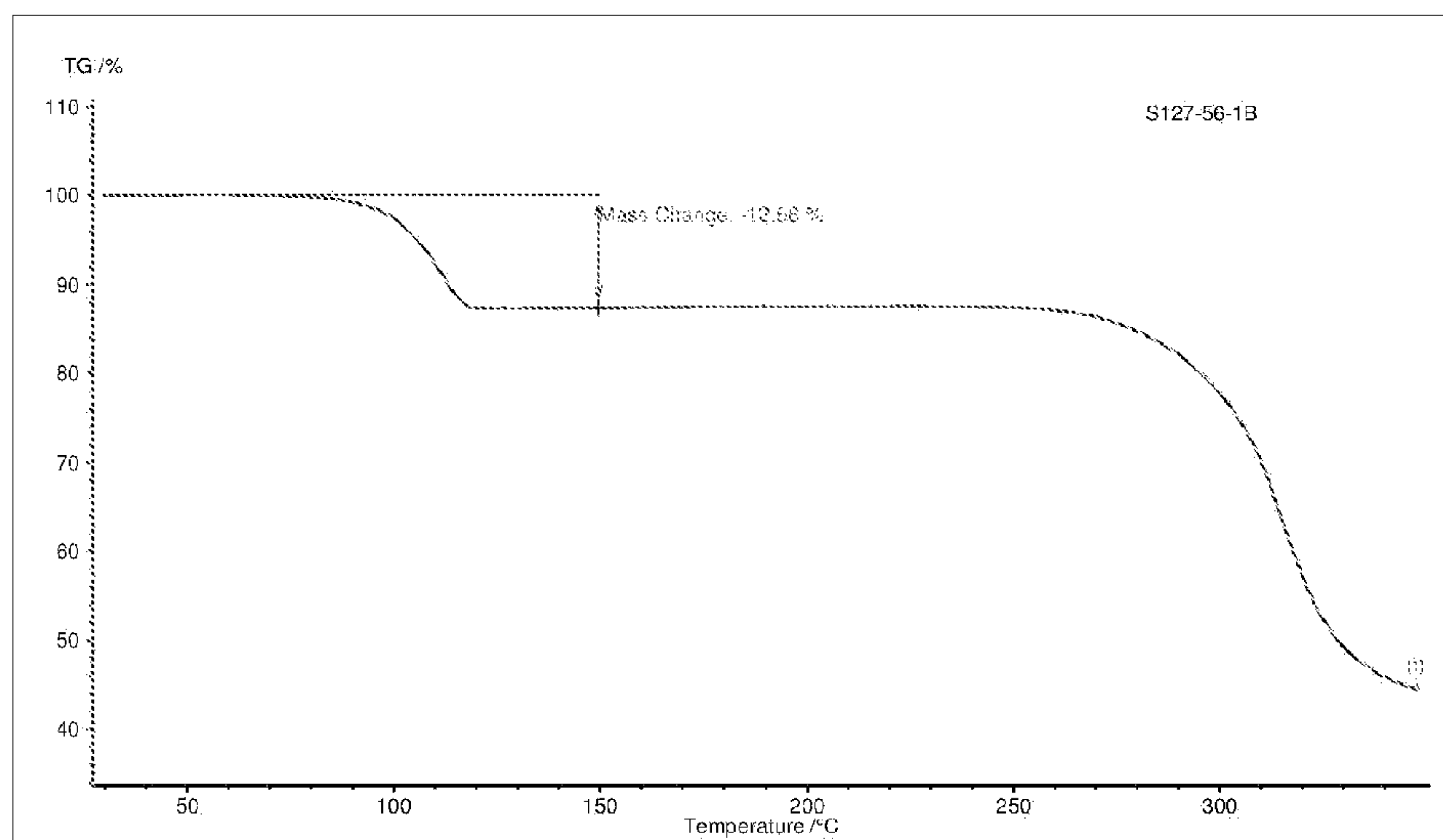


Figure 12 Thermogravimetric (TG) curve of Form IV

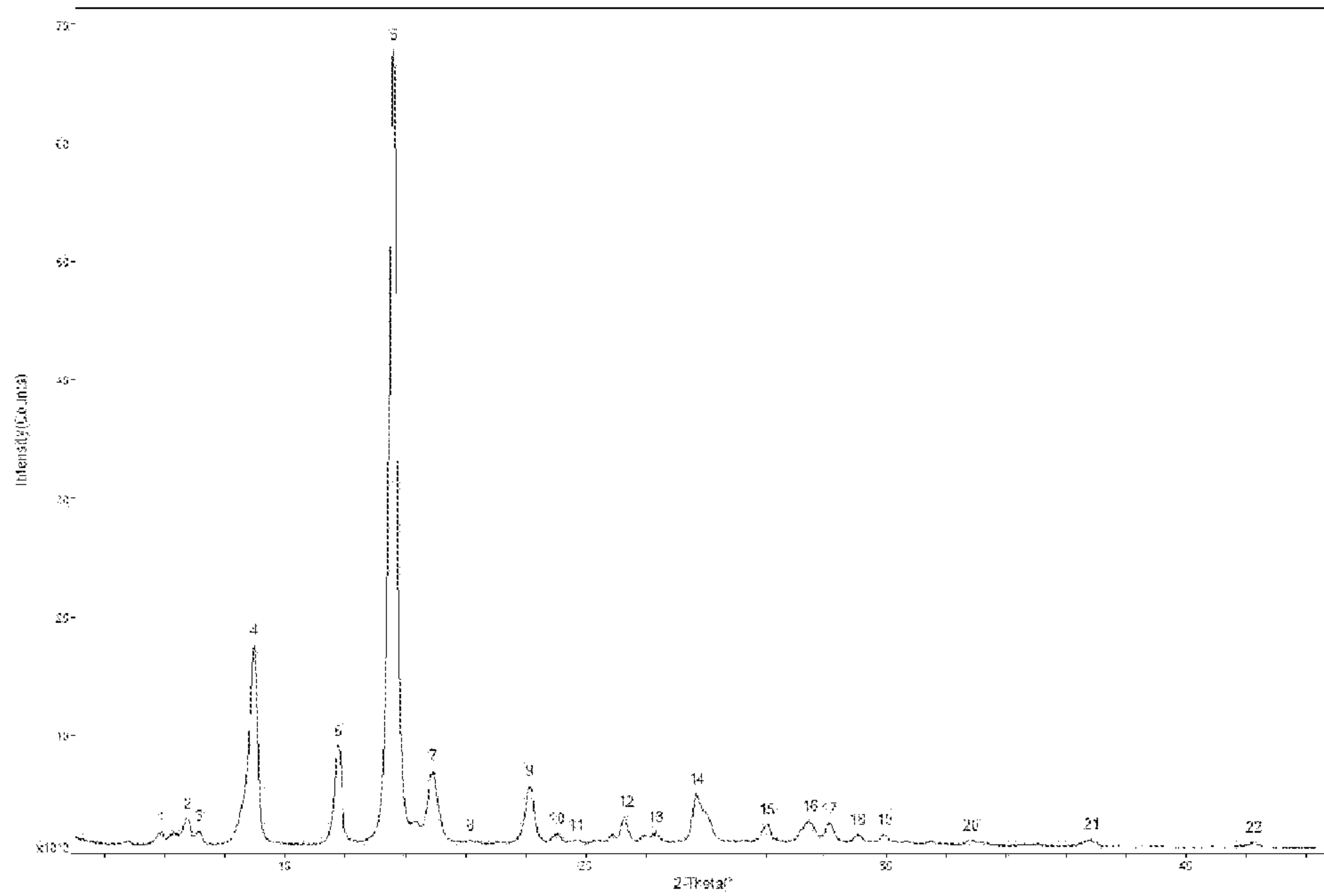


Figure 13 Powder X-ray diffractogram of Form VII

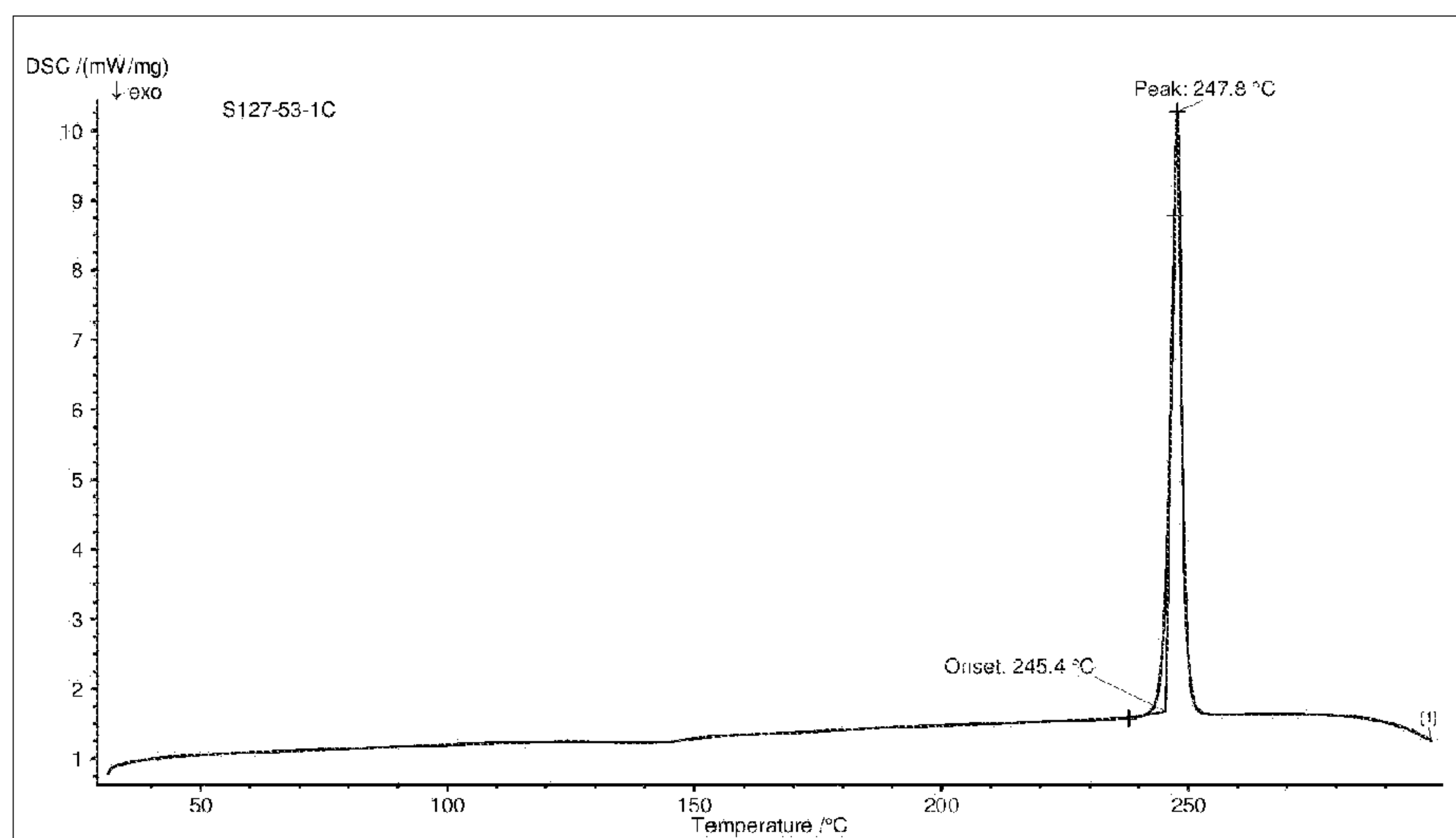


Figure 14 Differential scanning calorimeter (DSC) thermogram of Form VII

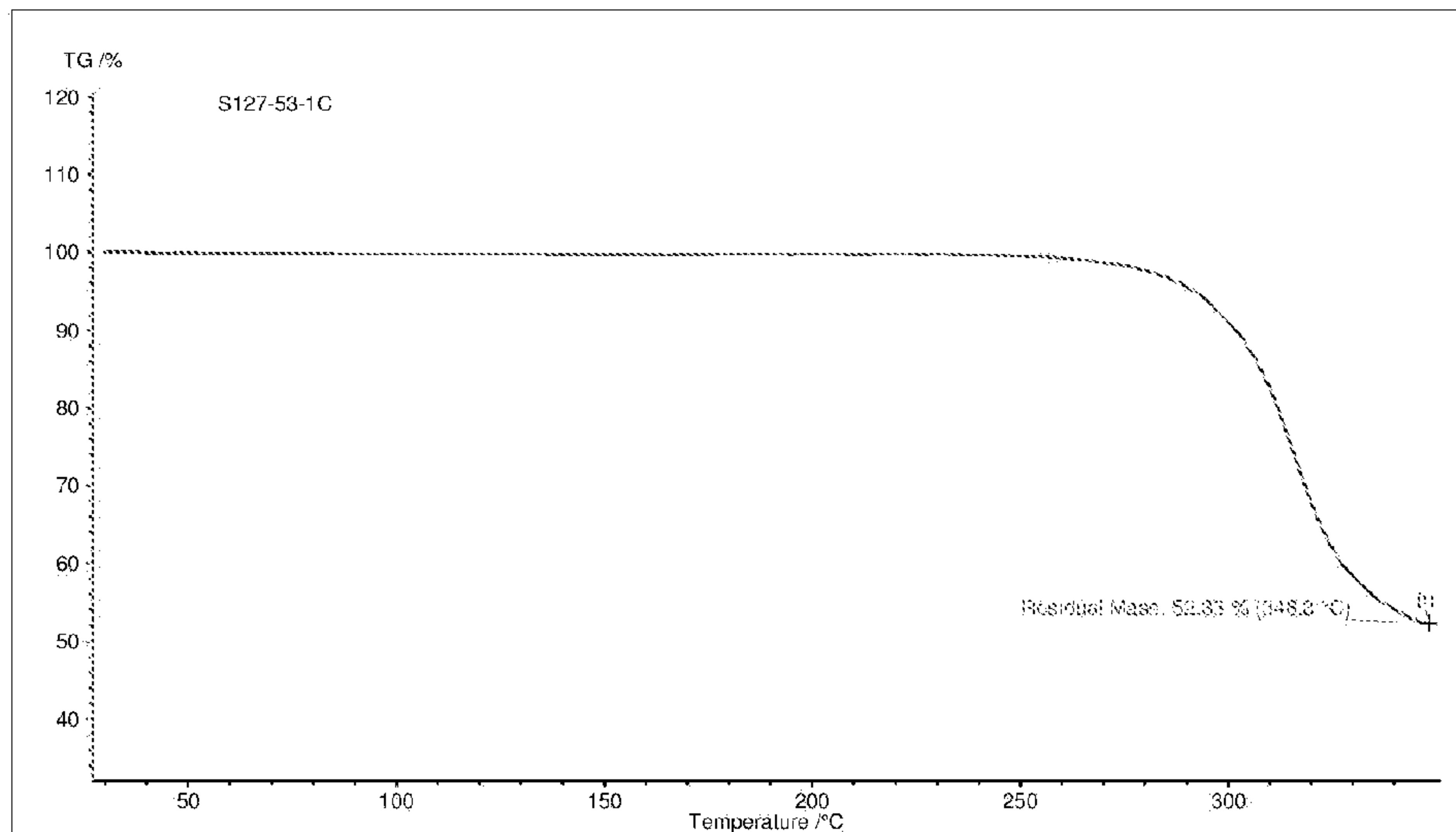


Figure 15 Thermogravimetric (TG) curve of Form VII

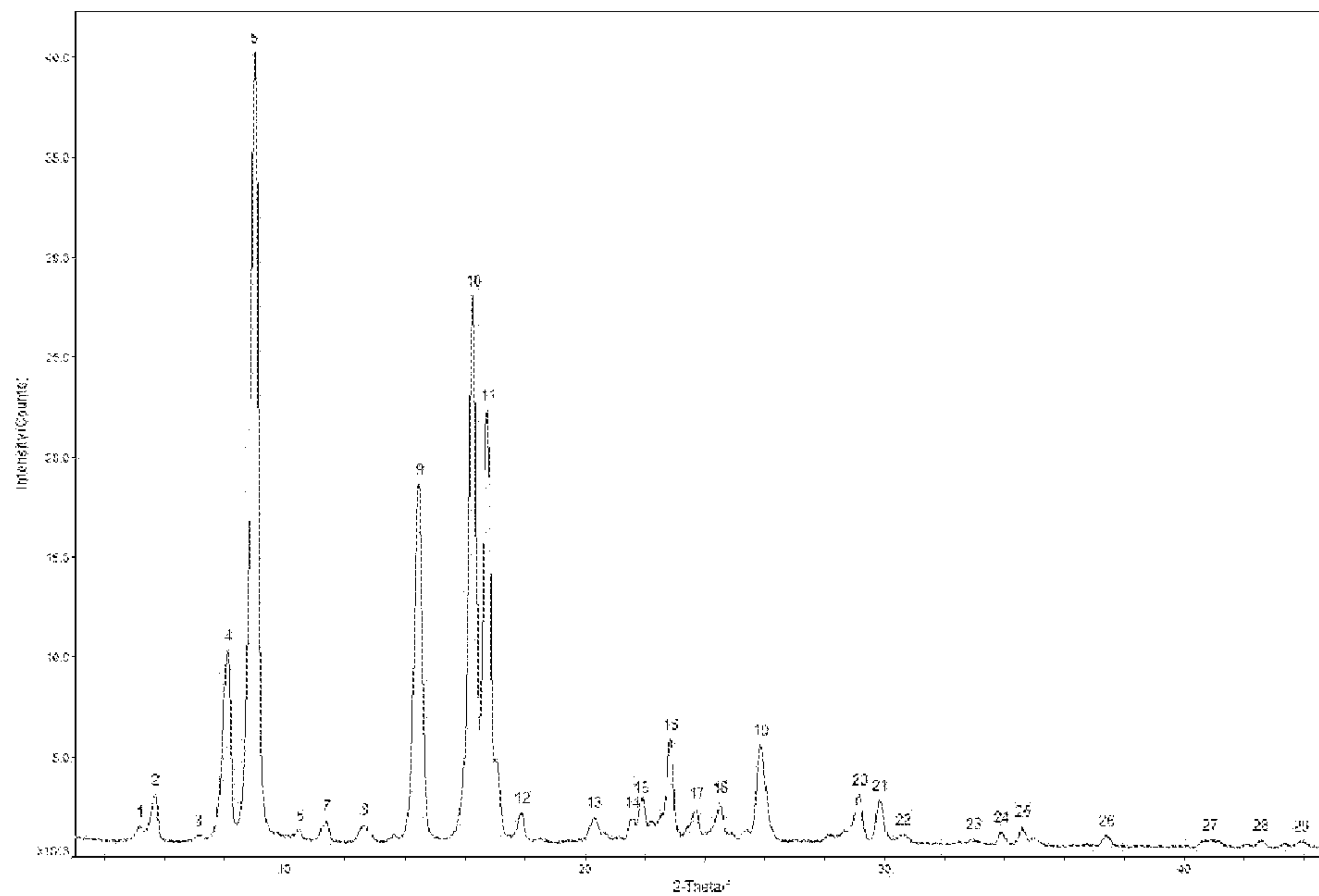


Figure 16 Powder X-ray diffractogram of Form VIII

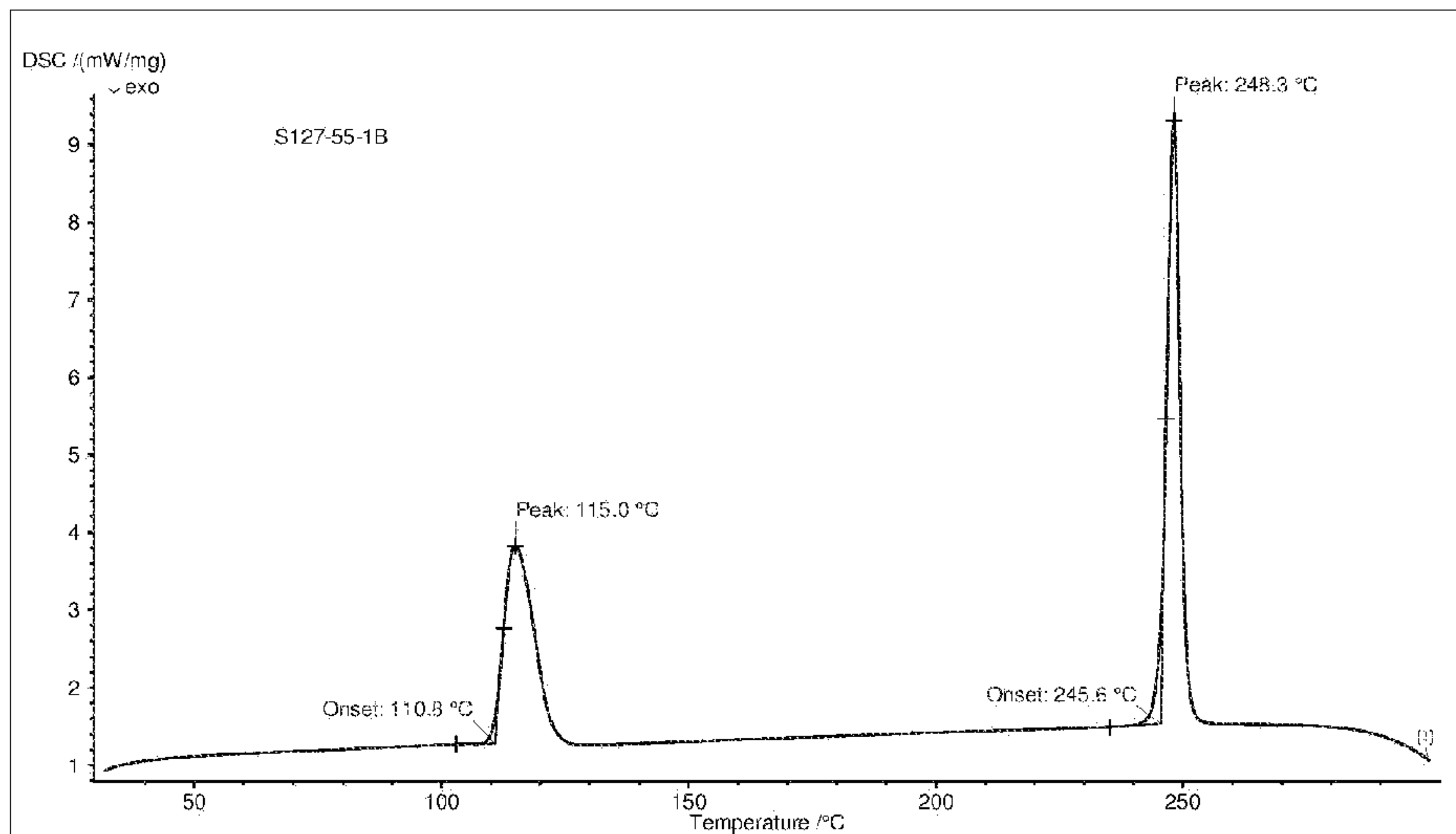


Figure 17 Differential scanning calorimeter (DSC) thermogram of Form VIII

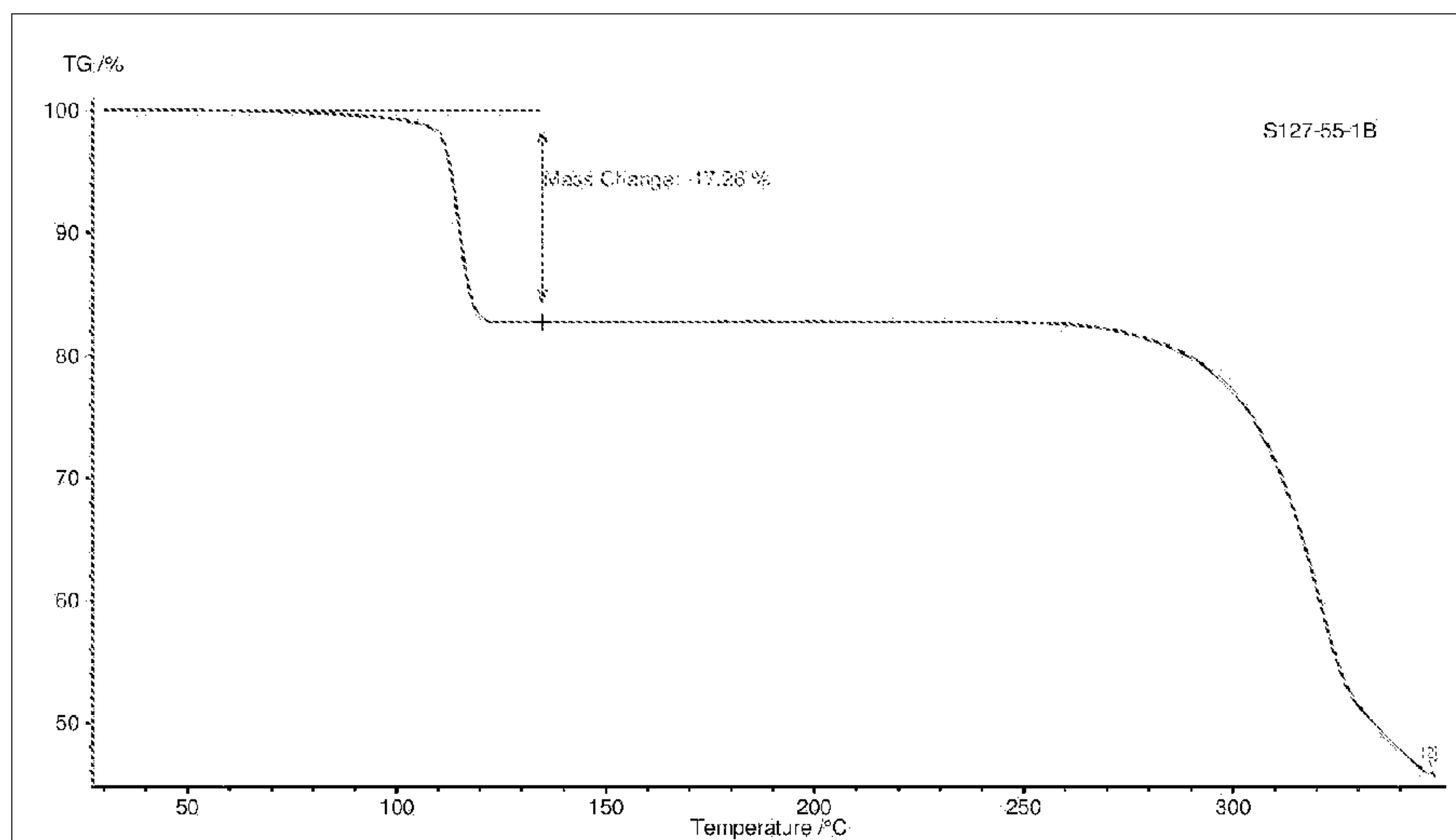


Figure 18 Thermogravimetric (TG) curve of Form VIII