



(51) International Patent Classification:

C08B 1/00 (2006.01) *B82Y 30/00* (2011.01)
C08B 15/00 (2006.01) *C08L 1/00* (2006.01)
B82B 3/00 (2006.01)

(21) International Application Number:

PCT/US2015/037043

(22) International Filing Date:

23 June 2015 (23.06.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/015,565 23 June 2014 (23.06.2014) US
 14/746,822 22 June 2015 (22.06.2015) US

(71) Applicant: API INTELLECTUAL PROPERTY HOLDINGS, LLC [US/US]; Attn: Ryan O'Connor, CIPO, 750 Piedmont Ave. NE, Atlanta, Georgia 30308 (US).

(72) Inventors: RETSINA, Theodora; 836 Penn Avenue, Atlanta, Georgia 30308 (US). NELSON, Kimberly; 213 Locust St. NE, Atlanta, Georgia 30317 (US).

(74) Agent: O'CONNOR, Ryan; 750 Piedmont Ave. NE, Atlanta, Georgia 30308 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,

KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:

18 February 2016

(54) Title: NANOCELLULOSE COMPOSITIONS AND PROCESSES TO PRODUCE SAME

(57) Abstract: A composition comprising nanocellulose is disclosed, wherein the nanocellulose contains very low or essentially no sulfur content. The nanocellulose may be in the form of cellulose nanocrystals, cellulose nanofibrils, or both. The nanocellulose is characterized by a crystallinity of at least 80%, an onset of thermal decomposition of 300F or higher, and a low light transmittance over the range 400-700 nm. Other variations provide a composition comprising lignin-coated hydrophobic nanocellulose, wherein the nanocellulose contains very low or essentially no sulfur content. Some variations provide a composition comprising nanocellulose, wherein the nanocellulose contains about 0.1 wt% equivalent sulfur content, or less, as SO₄ groups chemically or physically bound to the nanocellulose. In some embodiments, the nanocellulose contains essentially no hydrogen atoms (apart from hydrogen structurally contained in nanocellulose itself) bound to the nanocellulose. Various compositions, materials, and products may incorporate the nanocellulose compositions disclosed herein.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2015/037043

A. CLASSIFICATION OF SUBJECT MATTER		
C08L 1/00 (2006.01) C08B 1/00 (2006.01) C08B 15/00 (2006.01) B82B 3/00 (2006.01) B82Y 30/00 (2011.01) According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
C08L 1/00, C08B 1/00, B82B 3/00, B82Y 30/00, C08B 15/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
PatSearch (RUPTO internal), DWPI, Espacenet, RUPAT		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2014/085730 A1 (API INTELLECTUAL PROPERTY HOLDINGS, LLC) 05.06.2014, p. 2, paragraph [0025], p. 47, claims	1-12, 15-19 13, 14, 20
Y	Md. Nuruddin et al. Comparative study of properties of cellulose nanofibers from wheat straw obtained by chemical and chemi-mechanical treatments. ASME International Mechanical Engineering Congress & Exposition, 2014, pp. 1-6, p. 1, abstract	13, 14
Y	US 2013/0171439 A1 (ODED SHOSEYOV et al.) 04.07.2013, p. 3, paragraph [0043]	20
A	EP 2543755 A1 (OLYMPUS CORPORATION) 09.01.2013, p. 4, paragraph [0019], p. 5, paragraph [0027], [0028]	1-20
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: “T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention “A” document defining the general state of the art which is not considered to be of particular relevance “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone “E” earlier document but published on or after the international filing date “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “O” document referring to an oral disclosure, use, exhibition or other means “P” document published prior to the international filing date but later than the priority date claimed “&” document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
28 August 2015 (28.08.2015)		17 December 2015 (17.12.2015)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37		Authorized officer I. Eliseeva Telephone No. (499)240-33-55