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(71) Applicant: **SAINT-GOBAIN CERAMICS & PLASTICS, INC.** [US/US]; One New Bond Street, Worcester, Massachusetts 01615 (US).

(72) Inventors: **GACEK, Matthew**; 8A Demond Pond Row, Rutland, Massachusetts 01543 (US). **REHRIG, Paul W.**; 10 Olde Parish Ln, Sterling, Massachusetts 01564 (US). **SENDER, Michael**; 139 Antrim St, Apt 2, Cambridge, Massachusetts 02139 (US).

(74) Agent: **ABEL LAW GROUP, LLP** et al.; 8911 N Capital of Texas Hwy, Bldg. 4, Suite 4200, Austin, Texas 78759 (US).

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(54) Title: METHOD FOR FORMING A THREE-DIMENSIONAL BODY HAVING REGIONS OF DIFFERENT DENSITIES

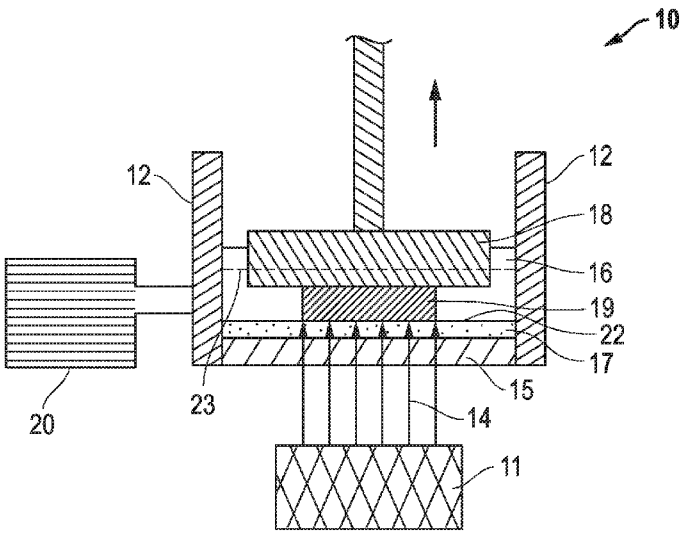


FIG. 1A

(57) Abstract: A method for continuously forming a three-dimensional body from a mixture, wherein the mixture can comprise solid particles and a radiation curable material. The method allows the continuous production of a three-dimensional body having at least one first region and at least one second region, wherein the at least one first region and the at least one second region can be different from each other based upon one or more criteria, such as density, content of solid particles, or average particle size.

[Continued on next page]

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

B29C 67/00(2006.01)i, B33Y 80/00(2015.01)i, B33Y 10/00(2015.01)i

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)
B29C 67/00; B32B 17/10; B29C 33/62; B23K 15/00; B22F 1/00; B29C 35/08; B29C 33/58; B33Y 80/00; B33Y 10/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: three-dimensional, radiation, cure, electromagnetic, first region, second region, density, content, solid particle, average particle size, inhibition, translate, ceramic

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009-0130449 A (EL-SIBLANI, ALI) 21 May 2009 See paragraphs [0059], [0065], [0066], [0079], [0089], claims 1, 2, 7, 8, 10, and figures 1, 5A.	1-7,9,10,13-15
Y		8,11,12
Y	US 2015-0071809 A1 (ARCAM AB) 12 March 2015 See paragraphs [0052]-[0061], claim 1, and figure 1.	8
Y	US 9205601 B2 (CARBON3D, INC.) 08 December 2015 See claim 2 and figure 2.	11
Y	US 8057731 B2 (ABE, SATOSHI) 15 November 2011 See column 5, lines 3-53, claim 1, and figures 4, 5.	12
A	US 2008-0036117 A1 (HICKERSON, KEVIN P. et al.) 14 February 2008 See paragraphs [0056]-[0058], claim 1, and figures 9A-9E.	1-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Name and mailing address of the ISA/KR
International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea
Facsimile No. +82-42-481-8578

Authorized officer
LEE, Myung Jin
Telephone No. +82-42-481-8474

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009-0130449 A1	21/05/2009	CN 101917925 A	15/12/2010
		CN 101917925 B	17/07/2013
		CN 101918199 A	15/12/2010
		CN 101918199 B	17/07/2013
		DK 2052693 T3	11/11/2013
		DK 2224874 T3	07/04/2014
		EP 2052693 A1	29/04/2009
		EP 2052693 B1	09/10/2013
		EP 2217429 A1	18/08/2010
		EP 2217429 B1	22/07/2015
		EP 2224874 A1	08/09/2010
		EP 2224874 B1	15/01/2014
		HK 1146463 A1	11/04/2014
		HK 1146475 A1	11/04/2014
		JP 2011-500382 A	06/01/2011
		JP 2015-063131 A	09/04/2015
		JP 5999851 B2	28/09/2016
		US 2009-0146344 A1	11/06/2009
		US 2011-0260365 A1	27/10/2011
		US 8003040 B2	23/08/2011
		US 8110135 B2	07/02/2012
		US 8658076 B2	25/02/2014
		WO 2009-053099 A1	30/04/2009
		WO 2009-053100 A1	30/04/2009
US 2015-0071809 A1	12/03/2015	CN 105705275 A	22/06/2016
		EP 3041625 A2	13/07/2016
		JP 2016-534234 A	04/11/2016
		US 9505057 B2	29/11/2016
		WO 2015-032590 A2	12/03/2015
		WO 2015-032590 A3	07/05/2015
US 9205601 B2	08/12/2015	CA 2898103 A1	21/08/2014
		CA 2898106 A1	21/08/2014
		CN 105122135 A	02/12/2015
		CN 105452958 A	30/03/2016
		DK 2956823 T3	05/09/2016
		EP 2956822 A2	23/12/2015
		EP 2956822 B1	29/06/2016
		EP 2956823 A2	23/12/2015
		EP 2956823 B1	29/06/2016
		ES 2588485 T3	03/11/2016
		HK 1215476 A1	19/05/2017
		HK 1215477 A1	19/05/2017
		HR P20161016 T1	21/10/2016
		JP 2016-509963 A	04/04/2016
		JP 2016-509964 A	04/04/2016
		KR 10-2015-0117273 A	19/10/2015
		KR 10-2015-0117275 A	19/10/2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		MX 2015010375 A	07/04/2016
		MX 2015010376 A	07/04/2016
		PL 2956823 T3	30/12/2016
		TW 201447478 A	16/12/2014
		US 2015-0097315 A1	09/04/2015
		US 2015-0097316 A1	09/04/2015
		US 2015-0102532 A1	16/04/2015
		US 2016-0059484 A1	03/03/2016
		US 2016-0059486 A1	03/03/2016
		US 2016-0059487 A1	03/03/2016
		US 9211678 B2	15/12/2015
		US 9216546 B2	22/12/2015
		WO 2014-126834 A2	21/08/2014
		WO 2014-126834 A3	13/11/2014
		WO 2014-126837 A2	21/08/2014
		WO 2014-126837 A3	24/12/2014
US 8057731 B2	15/11/2011	CN 101309766 A	19/11/2008
		CN 101309766 B	08/10/2014
		EP 1949989 A1	30/07/2008
		EP 1949989 B1	11/01/2012
		JP 4770838 B2	14/09/2011
		KR 10-0993923 B1	11/11/2010
		KR 10-2008-0066072 A	15/07/2008
		US 2009-0121393 A1	14/05/2009
		WO 2007-058160 A1	24/05/2007
US 2008-0036117 A1	14/02/2008	AT 516128 T	15/07/2011
		EP 1735133 A2	27/12/2006
		EP 1735133 B1	13/07/2011
		JP 2007-529349 A	25/10/2007
		US 2005-0208168 A1	22/09/2005
		US 2010-0244333 A1	30/09/2010
		US 7261542 B2	28/08/2007
		US 8119053 B1	21/02/2012
		WO 2005-089463 A2	29/09/2005
		WO 2005-089463 A3	07/12/2006
		WO 2008-067496 A2	05/06/2008
		WO 2008-067496 A3	09/04/2009