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[Continued on next page]

(54) Title: REFRACTORY OBJECT INCLUDING BETA ALUMINA AND PROCESSES OF MAKING AND USING THE SAME

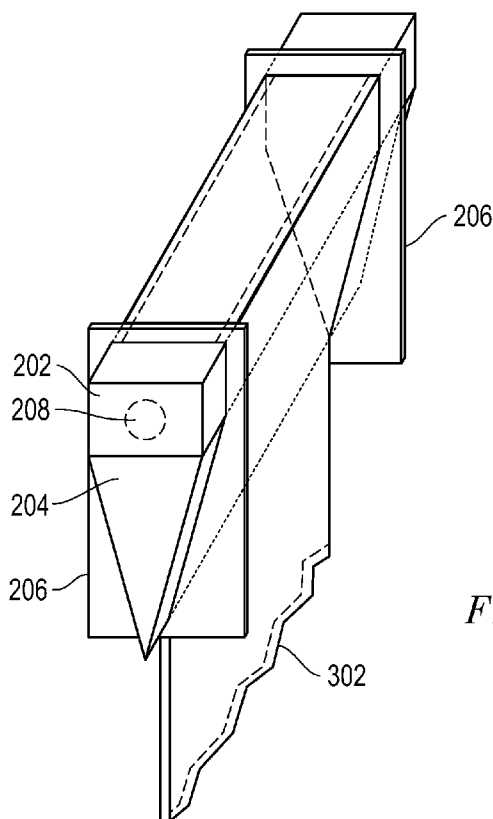


FIG. 7

(57) Abstract: A refractory object can include a beta alumina. In an embodiment, the refractory object is capable of being used in a glass fusion process. In another embodiment, the refractory object can have a total Al<sub>2</sub>O<sub>3</sub> content of at least 10 % by weight. Additionally, a Mg-Al oxide may not form along a surface of the refractory object when the surface is exposed to a molten glass including an Al-Si-Mg oxide. In a particular embodiment, a refractory object can be in the form of a glass overflow forming block used to form a glass object that includes an Al-Si-Mg oxide. When forming the glass object, the glass material contacts the beta alumina, and during the flowing of the glass material, a Mg-Al oxide does not form along the beta alumina at the surface.



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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- 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))

- 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:**

10 May 2013

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2012/033409****A. CLASSIFICATION OF SUBJECT MATTER***C03B 3/02(2006.01)i, C03B 5/00(2006.01)i, C03C 3/083(2006.01)i, C03C 3/085(2006.01)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)

C03B 3/02; C04B 35/10; C04B 7/44; C04B 35/66; C04B 35/113; B32B 5/00; C04B 35/043

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)

eKOMPASS(KIPO internal) & Keywords: Al<sub>2</sub>O<sub>3</sub>, refractory, glass, coating**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                    | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------|-----------------------|
| X<br>Y    | US 06077801 A (ZANOLI; ALAIN PAUL BERNARD et al.) 20 June 2000<br>See claim 1 and column 8, line 52-column 9, line 6. | 1,3-9<br>13, 14, 16   |
| A         | JP 02-069363 A (KAWASAKI REFRACT CO LTD) 08 March 1990<br>See the whole document.                                     | 1,3-9, 13, 14, 16     |
| Y         | US 2010-0151232 A1 (CABODI ISABELLE et al.) 17 June 2010<br>See claim 1 and paragraphs [0076],[0085],[0106].          | 13, 14                |
| Y         | JP 02-092871 A (NIPPON CEMENT CO LTD et al.) 03 April 1990<br>See abstract.                                           | 16                    |

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

28 FEBRUARY 2013 (28.02.2013)

Date of mailing of the international search report

**04 MARCH 2013 (04.03.2013)**

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# INTERNATIONAL SEARCH REPORT

International application No.

**PCT/US2012/033409**

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☒ Claims Nos.: 26,33,36,40-42,44,46  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:  
  
Claims 26,33,36,40-42,44,46 are indicated as dependent claims of claims 25,32,35,39,43,45, respectively. However, the claims 25,32,35,39,43,45 do not comply with PCT Rule 6.4(a), and thus they are not searchable, nor are their dependent claims 26,33,36,40-42,44,46.
  
3. ☒ Claims Nos.: 10-12,15,23-25,27-32,34,35,37-39,43,45,47-54  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

I. Claims 1,3-9,13,14,16 are directed to a refractory object comprising Al<sub>2</sub>O<sub>3</sub>, wherein at least 50wt% of the Al<sub>2</sub>O<sub>3</sub> comprises a beta alumina, and a process of forming the refractory object.

II. Claim 2 is directed to a refractory object comprising a total Al<sub>2</sub>O<sub>3</sub> content of at least 10wt%, wherein a Mg-Al oxide does not form along a surface of the refractory object when the surface is exposed to a molten glass.

III. Claim 17-22 are directed to a process of forming a glass object comprising: providing a refractory object that includes a glass overflow forming block comprising a beta alumina at a surface of the glass overflow forming block and flowing a glass material including Al-Si-Mg oxide into the glass overflow forming block and over a lip of the glass overflow forming block, wherein: the glass material contacts the beta alumina during the flowing of the glass material and a Mg-Al oxide does not form along the beta alumina at the surface.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
  
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1,3-9,13,14,16

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2012/033409**

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
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