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Declarations under Rule 4.17:

- 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))

[Continued on next page]

(54) Title: CERAMIC SHAPED ABRASIVE PARTICLES, METHODS OF MAKING THE SAME, AND ABRASIVE ARTICLES CONTAINING THE SAME

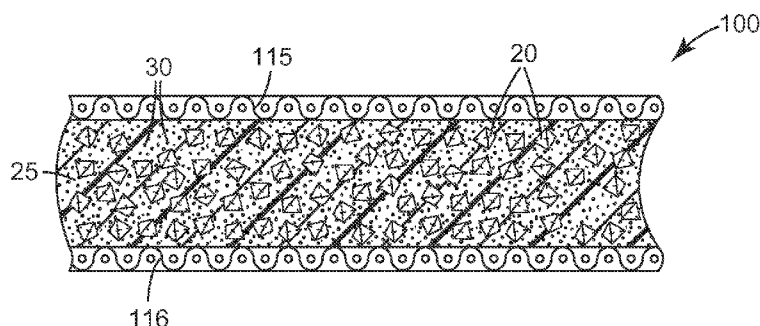


FIG. 2

(57) Abstract: Ceramic shaped abrasive particles have four major sides joined by six common edges. Each one of the four major sides contacts three other of the four major sides. The six common edges have substantially the same length. Methods of making the ceramic shaped particle are disclosed. The ceramic shaped abrasive particles are useful for abrading a surface of a workpiece. An abrasive article includes the ceramic shaped abrasive particles retained in a binder.



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- *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:**
2 February 2012

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/033188**A. CLASSIFICATION OF SUBJECT MATTER****B24D 3/00(2006.01)i, B24D 7/02(2006.01)i, C09K 3/14(2006.01)i, B24D 18/00(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)

B24D 3/00; B23F 21/03; B24B 1/00

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:ceramic, abrasive, particle, side, planar, concave

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 05690705A A (HOLMES; GARY L. et al.) 25 November 1997 see column 3, line 65 - column 18, line 14 and figure 4.	1-4,23-35
A	US 05201916A A (BERG; TODD A. et al.) 13 April 1993 see column 4, line 54 - column 15, line 12 and figure 7.	1-4,23-35
A	US 05560745A A (ROBERTS; ELLIS E.) 01 October 1996 see column 5, line 18 - column 15, line 40 and figure 1.	1-4,23-35



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

"&" document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2011/033188**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

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

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 5-22
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

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

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

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying 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.:

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/US2011/033188

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 05690705A A	25. 11. 1997	CN 1081971 C	03. 04. 2002
		CN 1126454 A	10. 07. 1996
		CN 1126454 C0	10. 07. 1996
		EP 0706440 A1	28. 04. 1999
		EP 0706440 A1	17. 04. 1996
		EP 0706440 B1	26. 04. 2000
		EP 0835724 A2	15. 04. 1998
		EP 0835724 A3	27. 09. 2000
		JP 03-579053 B2	20. 10. 2004
		JP 08-512074 A	17. 12. 1996
		KR 10-0339099 B1	11. 10. 2002
		US 05500273A A	19. 03. 1996
		US 05549962A A	27. 08. 1996
		US 05628952A A	13. 05. 1997
		US 05714259A A	03. 02. 1998
		WO 95-01241 A1	12. 01. 1995
US 05201916A A	13. 04. 1993	CN 1081948 A0	16. 02. 1994
		EP 0605823 A1	13. 07. 1994
		EP 0605823 B1	15. 09. 1999
		EP 0651778 A1	10. 05. 1995
		EP 0651778 B1	06. 05. 1998
		JP 06-278113 A	04. 10. 1994
		KR 10-1994-0013789 A	16. 07. 1994
		KR 10-1995-0702610 A	29. 07. 1995
		US 05304331A A	19. 04. 1994
		US 05366523A A	22. 11. 1994
		US 05984988A A	16. 11. 1999
		US 0RE35570E E	29. 07. 1997
		US 0RE035570E E	29. 07. 1997
		WO 94-02559 A1	03. 02. 1994
US 05560745A A	01. 10. 1996	EP 0779859 A1	25. 06. 1997
		EP 0779859 A1	29. 05. 2002
		EP 0779859 A4	02. 12. 1998
		EP 0779859 B1	09. 07. 2003
		US 05453106A A	26. 09. 1995
		US 06158952A A	12. 12. 2000
		WO 96-06732 A1	07. 03. 1996