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For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: CLEANING PROCESS AND APPARATUS FOR SILICATE MATERIALS

(57) Abstract: A method for treating a surface of a quartz substrate includes preparing a substrate to provide a working surface having an initial roughness; and then ultrasonically acid-etching the working surface to increase the roughness of the working surface by at least about 10%. In one embodiment, the initial surface roughness is greater than about 10 Ra, and in another embodiment the initial surface roughness is greater than about 200 Ra. In a still further embodiment, the initial surface area, if less than about 200 Ra, is increased to greater than about 200 Ra. In other embodiments of the present invention, the working surface roughness is increased by at least about 25% or at least about 50%. Simultaneous with the increase in surface area (as measured by the roughness), the surface defects are reduced to reduce particulate contamination from the substrate.



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/23597

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : C23F 1/00

US CL : 216/2

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)

U.S. : Please See Continuation Sheet

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)

Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,368,410 B1 (GORCZYCA et al) 09 April 2002 (09.04.2002), column 3, line 10 - column 6, line 6.	16, 20-26, 30
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Y		1-7, 12, 13, 15
X	US 2003/0096562 A1 (KUROGOUCHI) 22 May 2003 (22.05.2003), paragraphs 11-73.	31-37
X	JP 50087974 A (MATSUSHITA) 15 July 1975 (15.07.1975), see entire abstract.	1, 6, 7
Y	US 4,957,583 (BUCK et al) 18 September 1990 (18.09.1990), column 1, lines 18-68.	1-7, 12, 13, 15

☐ 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 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 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

"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

02 June 2005 (02.06.2005)

Date of mailing of the international search report

29 JUL 2005

Name and mailing address of the ISA/US

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/23597

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.:
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:
Please See Continuation Sheet

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.

☒

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US04/23597

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group I, claims 1-15, drawn to an etching method.

Group II, claims 16-30, drawn to a cleaning method.

Group III, claims 31-37, drawn to a grit blasting apparatus.

The inventions listed as Groups I, II and III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group I is directed at a method of ultrasonic etching which removes a portion of a substrate and does not share a special technical feature with Group II which is distinct from a cleaning method which removes contamination from the surface of a substrate.

Group III is directed at an apparatus that is used for grit blasting having a special technical feature of a drive mechanism that provides relative motion between nozzle and base during a roughening operation. Although the grit blasting apparatus may be used to perform a step in the methods described in Groups I and II, The special technical feature is not required to perform the methods recited in Groups I and II which could be performed using a grit blasting apparatus without the claimed special technical feature.

Continuation of B. FIELDS SEARCHED Item 1:

216/2, 52, 79, 80, 99;
438/690, 691, 704, 723, 746, 756;
451/38, 39, 75, 102;
134/1, 1.3, 2, 3

Continuation of B. FIELDS SEARCHED Item 3:

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/23597

EAST (USPAT, USPGPUB, JPO, EPO, DERWENT, IBMTDB) search terms: quartz, silica, silicon oxide, SiO₂, glass, etch, polish, blast, grit, nozzle, angle, abrasive, sand, acid, nitric, hydrofluoric, ultrasonic, roughness, silicon e-DAN, EAST (inventor name search)