ADHESIVE OF A SILICON AND SILICA COMPOSITE PARTICULARLY USEFUL FOR JOINING SILICON PARTS

A method of joining two silicon members (30, 32), the adhesive (44, 46) used for the method, and the joined product, especially a silicon tower (10) for supporting multiple silicon wafers (22). A flowable adhesive is prepared comprising silicon particles (44) of size less than 100 µm and preferably less than 100 nm and a silica bridging agent, such as a spin-on glass, which forms a silicate glass (46). Nano-silicon crystallites of about 20 nm size may be formed by CVD. Larger particles may be milled from virgin polysilicon. If necessary, a retardant such as heavy, preferably water-insoluble alcohol such as terpineol is added to slow setting of the adhesive at room temperature. The mixture is applied to the joining areas. The silicon parts are assembled and annealed at a temperature sufficient to link the silica, preferably at 900 °C to 100 °C for nano-silicon but higher for milled silicon.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H01L 31/0392; H01L 21/30; B65D 85/90; F27D 5/00; A47G 19/08
US CL : 211/41.18,41.12; 438/151,459; 428/119

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. : 211/41.18,41.12; 438/151,459; 428/119

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 6,051,452 (SHIGYO et al) 18 April 2000 (18.04.2000), see entire document.</td>
<td>1-21</td>
</tr>
<tr>
<td>A</td>
<td>US 6,056,123 (NIEMIROWSKI et al.) 2 May 2000 (02.05.2000), see entire document.</td>
<td>22-32</td>
</tr>
<tr>
<td>A</td>
<td>US 6,099,302 (HONG et al.) 8 August 2000 (08.08.2000), see entire document.</td>
<td>22-32</td>
</tr>
<tr>
<td>A</td>
<td>US 6,450,346 (BOYLE et al.) 17 September 2002 (17.09.2002), see entire document.</td>
<td>22-32</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.

See patent family annex.

*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

*E* document member of the same patent family

Date of the actual completion of the international search

13 May 2005 (13.05.2005)

Date of mailing of the international search report

25 May 2005

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