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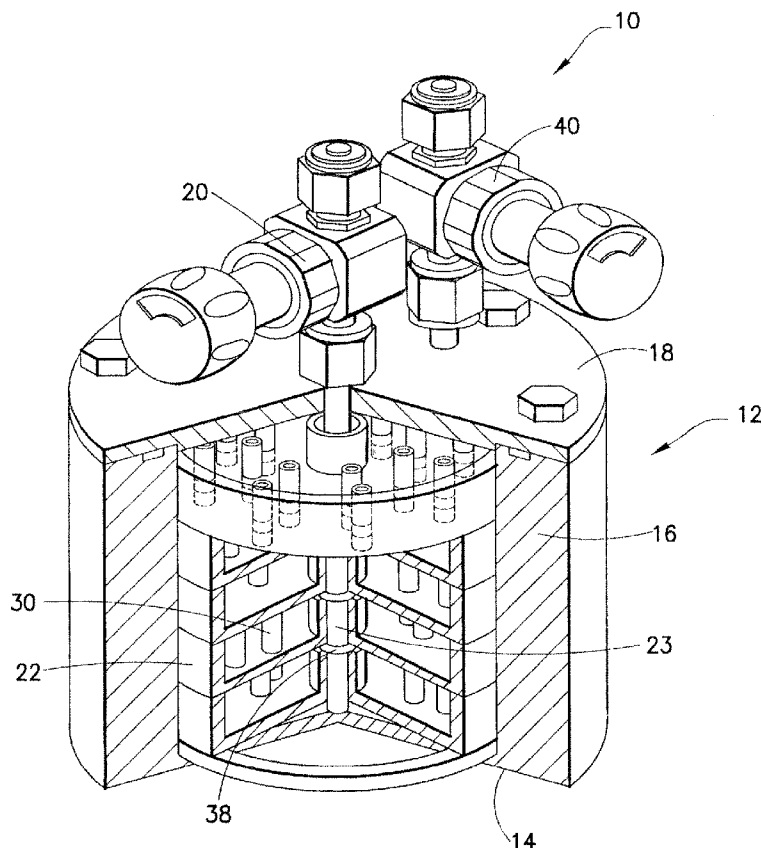
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[Continued on next page]

(54) Title: SOLID PRECURSOR-BASED DELIVERY OF FLUID UTILIZING CONTROLLED SOLIDS MORPHOLOGY



(57) Abstract: Apparatus and method for volatilizing a source reagent susceptible to particle generation or presence of particles in the corresponding source reagent vapor, in which such particle generation or presence is suppressed by structural or processing features of the vapor generation system. Such apparatus and method are applicable to liquid and solid source reagents, particularly solid source reagents such as metal halides, e.g., hafnium chloride. The source reagent in one specific implementation is constituted by a porous monolithic bulk form of the source reagent material. The apparatus and method of the invention are usefully employed to provide source reagent vapor for applications such as atomic layer deposition (ALD) and ion implantation.

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<p>A. CLASSIFICATION OF SUBJECT MATTER IPC: C23C 16/00 (2006.01)</p> <p>USPC: 261/23.1,142,147,DIG.65;34/380,497,510;118/726 According to International Patent Classification (IPC) or to both national classification and IPC</p>																	
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) U.S. : 261/23.1,74,121.1,124,142,147,Dig.65,Dig.89; 34/209,211,359,380,493,497,510; 118/726</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched None</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EAST Search Terms: vaporizer, solid, reagent, heating, thermal, control, inlet, outlet, carrier, gas</p>																	
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <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 5,904,771 A (TASAKI et al) 18 May 1999 (18.05.1999), abstract.</td> <td>1-143</td> </tr> <tr> <td>A</td> <td>US 6,270,839 B1 (ONOE et al) 07 August 2001 (07.08.2001), fig. 4.</td> <td>1-143</td> </tr> <tr> <td>Y</td> <td>US 2005/0006799 A1 (GREGG et al) 13 January 2005 (13.01.2005), figs. 3-9, paragraphs [0010],[0011],[0013],[0029],[0033],[0037]-[0041],[0060],[0064],[0081]-[0087],[0100],[0105]-[0106],[0137]-[0147],[0152]-[0153].</td> <td>19,23,40,41,49,53-55,62,63,92,109,110</td> </tr> <tr> <td>A</td> <td>US 6,921,062 B2 (GREGG et al) 26 July 2005 (26.07.2005), abstract.</td> <td>1-143</td> </tr> </tbody> </table>			Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	A	US 5,904,771 A (TASAKI et al) 18 May 1999 (18.05.1999), abstract.	1-143	A	US 6,270,839 B1 (ONOE et al) 07 August 2001 (07.08.2001), fig. 4.	1-143	Y	US 2005/0006799 A1 (GREGG et al) 13 January 2005 (13.01.2005), figs. 3-9, paragraphs [0010],[0011],[0013],[0029],[0033],[0037]-[0041],[0060],[0064],[0081]-[0087],[0100],[0105]-[0106],[0137]-[0147],[0152]-[0153].	19,23,40,41,49,53-55,62,63,92,109,110	A	US 6,921,062 B2 (GREGG et al) 26 July 2005 (26.07.2005), abstract.	1-143
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<p><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.</p>																	
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"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</td> </tr> <tr> <td>"E" earlier application or patent published on or after the international filing date</td> <td>"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</td> </tr> <tr> <td>"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)</td> <td>"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</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance	"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	"E" earlier application or patent published on or after the international filing date	"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	"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)	"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	"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	"P" document published prior to the international filing date but later than the priority date claimed						
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"P" document published prior to the international filing date but later than the priority date claimed																	
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<p>Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201</p>		<p>Authorized Officer Scott Bushy <i>Manu J. Wats</i> Telephone No. 571 272-1153</p>															

INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X --- Y	US 2006/0024439 A2 (TUOMINEN et al) 02 February 2006 (02.02.2006), abstract; figs: 2,4,5,7; paragraphs [0026],[0027],[0029],[0032],[0037]-[0039],[0055].	1-18,20,22,24-29,31-33,35,37-39,43-48,50-52,56-58,60,61,64-91,93,95-100,102,104,106-108,112-143 ----- 19,23,40,41,49,53-55,62,63,92,109,110