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(54) Title: HIGH RATE DEPOSITION IN A BATCH REACTOR

(57) Abstract: A chemical vapor deposition reactor (59) including a wafer (60) boat (77) with a vertical stack of horizontally oriented susceptors (62) serving as thermal plates (76) and each having pins (228) extending upward for suspending a wafer (60) between a pair of susceptors (62). Reactant gas injector (65) and exhaust apparatus (272) are positioned to concentrate a forceful supply of reactant gas across each wafer (60) at a speed in excess of 10 cm/sec. The pressure is held in the range of 0.1 to 5,000 mTorr. The forceful gas flow avoids gas depletion effects, thinning the boundary layer and resulting in faster delivery of reactants to substrate surfaces, resulting in surface rate reaction limited operation. A plurality of individually controllable heaters (78) are spaced vertically around the sides of the boat (77). Temperature sensors (130) monitor the temperature along the boat (77) height and provide input to a controller (118) for adjusting the heater drive to optimize the temperature uniformity.



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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/24253

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : C23C 16/453, 455  
 US CL : 118/715, 719, 666

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)  
 Examiner Assisted Search Tool (EAST)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|------------------------------------------------------------------------------------|-----------------------|
| Y          | US 4,745,088 A (INOUE et al) 17 May 1988 (17.05.1988), column 6, lines 15-30       | 1, 11-16              |
| Y          | US 5,310,339 A (USHIKAWA) 10 May 1994 (10.05.1994), item 70, Figure 8              | 1, 11-16              |
| Y          | US 5,522,934 A (SUZUKI) 04 June 1996 (04.06.1996), column 1, lines 5-10            | 2-6                   |
| Y          | US 4,753,192 A (GOLDSMITH) 28 June 1988 (28.06.1988), column 3, lines 1-16         | 7-10, 17-19           |
| Y          | US 6,029,602 A (BHATNAGAR) 29 February 2000 (29.02.2000) Figure 1                  | 20                    |

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents:

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

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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

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"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

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**INTERNATIONAL SEARCH REPORT**

PCT/US03/24253

**Continuation of Item 4 of the first sheet:**

Deficiency: The title is greater than seven words.

NEW TITLE: HIGH RATE DEPOSITION IN A BATCH REACTOR

**Continuation of B. FIELDS SEARCHED Item 1:**

118/715, 719, 666, 728, 50; 156/345.29, 345.33-345.36, 345.26, 345.51

137/262-264, 454.2, 560, 561r, 561, 571-576, 590, 594-596, 599.01, 599.05-599.07, 602