US006753271B2

(12) **United States Patent**
Sarigiannis et al.

(10) **Patent No.: US 6,753,271 B2**

(45) **Date of Patent: Jun. 22, 2004**

(54) **ATOMIC LAYER DEPOSITION METHODS**

(75) Inventors: **Demetrius Sarigiannis**, Boise, ID (US); **Garo J. Derderian**, Boise, ID (US); **Cem Basceri**, Boise, ID (US); **Gurtej S. Sandhu**, Boise, ID (US); **F. Daniel Gealy**, Kuna, ID (US); **Chris M. Carlson**, Boise, ID (US)

(73) Assignee: **Micron Technology, Inc.**, Boise, ID (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/222,282**

(22) Filed: **Aug. 15, 2002**

(65) **Prior Publication Data**

US 2004/0033688 A1 Feb. 19, 2004

(51) **Int. Cl.**[7] **H01L 21/44**; H01L 21/31; H01L 21/469

(52) **U.S. Cl.** **438/785**; 438/680; 438/681; 438/685; 438/688

(58) **Field of Search** 438/763, 785, 438/680, 681, 685, 688; 427/585, 255.28

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,879,459 A		3/1999	Gadgil et al.	118/715
5,925,411 A		7/1999	van de Ven et al.	427/248.1
5,972,430 A		10/1999	DiMeo, Jr. et al.	427/255.32
6,174,377 B1		1/2001	Doering et al.	118/729
6,200,893 B1		3/2001	Sneh	438/685
6,270,572 B1		8/2001	Kim et al.	
6,287,965 B1		9/2001	Kang et al.	438/648
6,301,434 B1		10/2001	McDiarmid et al.	392/416
6,305,314 B1		10/2001	Sneh et al.	
6,355,561 B1	*	3/2002	Sandhu et al.	438/676
6,387,185 B2		5/2002	Doering et al.	118/729
6,391,785 B1		5/2002	Satta et al.	438/704
6,403,156 B2	*	6/2002	Jang et al.	427/255.34
6,426,307 B2	*	7/2002	Lim	438/778
6,451,119 B2		9/2002	Sneh et al.	118/715
6,451,695 B2		9/2002	Sneh	438/685
6,468,924 B2	*	10/2002	Lee et al.	438/763
6,475,276 B1		11/2002	Elers et al.	117/84
6,475,286 B1		11/2002	Frijlink	118/719
6,475,910 B1		11/2002	Sneh	438/685
6,482,262 B1	*	11/2002	Elers et al.	117/84
6,534,395 B2		3/2003	Werkhoven et al.	
6,585,823 B1		7/2003	Van Wijck	
6,586,343 B1		7/2003	Ho et al.	438/758
6,589,886 B2		7/2003	Kim et al.	438/758
6,590,251 B2		7/2003	Kang et al.	257/310

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

WO	01/27347 A1	4/2001	16/44
WO	01/29280 A1	4/2001	16/32
WO	01/29893 A1	4/2001	21/768
WO	01/66832 A2	9/2001	25/14

Primary Examiner—Alexander Ghyka

(74) *Attorney, Agent, or Firm*—Wells St. John P.S.

(57) **ABSTRACT**

The invention includes an atomic layer deposition method of forming a layer of a deposited composition on a substrate. The method includes positioning a semiconductor substrate within an atomic layer deposition chamber. On the substrate, an intermediate composition monolayer is formed, followed by a desired deposited composition from reaction with the intermediate composition, collectively from flowing multiple different composition deposition precursors to the substrate within the deposition chamber. A material adheres to a chamber internal component surface from such sequentially forming. After such sequentially forming, a reactive gas flows to the chamber which is different in composition from the multiple different deposition precursors and which is effective to react with such adhering material. After the reactive gas flowing, such sequentially forming is repeated. Further implementations are contemplated.

49 Claims, 2 Drawing Sheets