



US006525365B1

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

(10) **Patent No.:** **US 6,525,365 B1**
(45) **Date of Patent:** **Feb. 25, 2003**

(54) **DIELECTRIC FILMS AND CAPACITOR STRUCTURES INCLUDING SAME**

EP 0 892 426 A2 1/1999
EP 0 957 522 A2 11/1999

(75) Inventors: **Cem Basceri**, Boise; **Dan Gealy**, Kuna, both of 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.: **09/652,907**

(22) Filed: **Aug. 31, 2000**

Related U.S. Application Data

(62) Division of application No. 09/385,581, filed on Aug. 31, 1999.

(51) **Int. Cl.**⁷ **H01L 29/76; H01L 27/108**

(52) **U.S. Cl.** **257/310; 257/311**

(58) **Field of Search** **257/310, 34**

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,270,241 A	12/1993	Dennison et al.	
5,392,189 A	2/1995	Fazan et al.	
5,614,018 A	3/1997	Azuma et al.	
5,656,329 A	8/1997	Hampden-Smith et al.	
5,663,089 A	9/1997	Tomozawa et al.	427/576
5,719,417 A	2/1998	Roeder et al.	
5,723,361 A	3/1998	Azuma et al.	438/180
5,736,759 A	4/1998	Haushalter	
5,783,253 A	7/1998	Roh	
5,989,927 A	11/1999	Yamonobe	438/3
6,101,085 A	8/2000	Kawahara et al.	
6,215,650 B1 *	4/2001	Gnade et al.	
6,258,654 B1 *	6/2001	Gocho	
6,287,935 B1 *	9/2001	Coursey	

FOREIGN PATENT DOCUMENTS

EP 0 810 866 A1 12/1997

OTHER PUBLICATIONS

Basceri, "Electrical and Dielectrical Properties of (Ba,Sr)TiO₃ Thin Film Capacitors for Ultra-High Density Dynamic Random Access Memories," A dissertation submitted to the Graduate Faculty of North Carolina State University, pp. 1-171 (1997).

Basceri et al., "The dielectric response as a function of temperature and film thickness of fiber-textured (Ba,Sr)TiO₃ thin films grown by chemical vapor deposition," *J. Appl. Phys.*, 82(5), 2497-2503 (1997).

S. Stemmer et al., "Accommodation of nonstoichiometry in (100) fiber-textured (Ba_xSr_{1-x})Ti_{1+y}O_{3+z} thin films grown by chemical vapor deposition," *Applied Physics Letters*, 74:(17) 2432-2434 (1999).

S. K. Streiffer et al., "Ferroelectricity in thin films: The dielectric response of fiber-textured (Ba_xSr_{1-x})Ti_{1+y}O_{3+z} thin films grown by chemical vapor deposition," *J. of Applied Physics*, 86:(8) 4565-4575 (1999).

* cited by examiner

Primary Examiner—Stephen D. Meier
(74) *Attorney, Agent, or Firm*—Muetting, Raasch & Gebhardt, P.A.

(57) **ABSTRACT**

The present invention provides a method for forming a dielectric film, e.g., a barium-strontium-titanate film, preferably having a thickness of less than about 600 Å. According to the present invention, the dielectric film is preferably formed using a chemical vapor deposition process in which an interfacial layer and a bulk layer are formed. The interfacial layer has an atomic percent of titanium less than or equal to the atomic percent of titanium in the bulk layer. Such films are particularly advantageous for use in memory devices, such as dynamic random access memory (DRAM) devices.

25 Claims, 1 Drawing Sheet

