



Strasbourg (France)

**E-MRS IUMRS ICEM 2006 Spring Meeting
Nice, France - May 29 – June 2, 2006**

SYMPOSIUM L

Characterization of High-k Dielectric Materials

Symposium Organizers:

Jarek Dabrowski, IHP, Frankfurt (Oder), Germany

Paul Hurley, Tyndall National Institute, Cork, Ireland

Junichi Murato, University of Tohoku, Japan

Eicke R. Weber, University of California, Berkeley, USA

Symposium Support

Papers to be published in Materials Science in Semiconductor Processing

Poster Session 4b : Physical and Electrical Properties

Tuesday, May 30, 2006

16:30 - 18:30

- L 4b 01 STRUCTURAL AND ELECTRONIC PROPERTIES OF ZIRCONIA PHASES :
R. Terki, G. Bertrand, H. Aourag and C. Coddet. Laboratoire d'Études et de Recherches sur les Matériaux, les Procédés et les Surfaces, Université de Technologie de Belfort-Montbéliard, Site de Sévenans, 90010 Belfort, France
- L 4b 02 Spectroscopic ellipsometry characterization of ZrO₂ thin films by nitrogen assisted reactive magnetron sputtering
L.Q.Zhu(a), Q.Fang(a,b), G.He(a), M.Liu(a), X.X.Xu(a), L.D.Zhang(a) a: Key Laboratory of Materials Physics, Anhui Key Laboratory of Nanomaterials and Nanostructure, Institute of Solid State Physics, Chinese Academy of Science, P.O.Box 1129, Hefei 230031, P.R.China b: London Centre for Nanotechnology and Electronic & Electrical Engineering, University College London, Torrington Place, London WC1E 7JE, UK
- L 4b 03 Microstructure of High-k HfAlxO_{2-x} Thin Films and Control of Leakage Current by High Concentration Ozone Oxidation
A. P. Huang and Paul K. Chu * Department of Physics and Materials Science, City University of Hong Kong Tat Chee Avenue, Kowloon, Hong Kong
- L 4b 04 ELECTRICAL PROPERTIES OF Al₂O₃-HfTiO GATE DIELECTRIC STACKS WITH LESS THAN 0.8 NM EQUIVALENT OXIDE THICKNESS
V. Mikhelashvili and G. Eisenstein, Department of Electrical Engineering, Technion-Israel Institute of Technology, Haifa 3200, Israel
- L 4b 05 Suppressed Interlayer and Dielectric Properties of Carbon-Doped High-k ZrO₂ Thin Films
A. P. Huang and Paul K. Chu * Department of Physics and Materials Science, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong
- L 4b 06 Conduction mechanisms and trapping in sputtered HfO₂ films
L Wang, D Liu, J Robertson, Engineering Dept, Cambridge University, Cambridge CB2 1PZ, UK
- L 4b 07 EPR characterization of defects in monoclinic powders of ZrO₂ and HfO₂
R.C. Barklie and S. Wright School of Physics, Trinity College, Dublin 2, Ireland.
- L 4b 08 Low-Temperature Conductance Measurements of Surface States in HfO₂-Si Structures with Different Gate Materials
Yu.Gomenyuk¹, A.Nazarov¹, Ya.Vovk¹, Yi Lu², Octavian Buiu², Steve Hall², J.K. Efavi³ and M.C. Lemme³ ¹ Institute of Semiconductor Physics, NASU, 41, pr. Nauky, 03028 Kiev, Ukraine ² Department of Electrical Engineering and Electronics, Brownlow Hill, University of Liverpool, Liverpool, L69 3GJ, UK ³ Advanced Microelectronic Center Aachen (AMICA), AMO GmbH, Huyskensweg 25, 52074 Aachen
- L 4b 09 Interfacial Reactions between High-k Praseodymium Aluminate and TiN
G. Lippert, J. Dabrowski, I. Costina, G. Lupina, V. Melnik, L. Oberbeck*, U. Schroeder*, Ch. Wenger, P. Zaumseil, and H.-J. Muessig IHP, Im Technologiepark 25, 15236 Frankfurt (Oder), Germany, *Infineon Technologies AG, 01099 Dresden, Germany
- L 4b 10 Electrical and interfacial characteristics of nanolaminate (Al₂O₃/ZrO₂/Al₂O₃) gate stack on fully-depleted SiGe-on-insulator
Zengfeng Di (a), Miao Zhang, Weili Liu, Qinwo Shen, Suhua Luo (a), Zhitang Song, Chenglu Lin The Research Center of Semiconductor Functional Film Engineering Technology & State Key Laboratory of Functional Materials for Informatics, Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences (CAS), Shanghai 200050, People's Republic of China Anping Huang, and Paul K. Chu (b) Department of Physics and Material Science, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, China (a) Also affiliated with Department of Physics & Materials Science, City University of Hong Kong, Hong Kong, China (b) Corresponding author
- L 4b 11 The effect of quenching media on the surface heat transfer coefficient of electronic materials
Seunghwan Ma, and Youngman Kim, Hanyang University, Korea
- L 4b 12 Point defects in dielectrics based on Pr oxides
J. Dabrowski, IHP, Im Technologiepark 25, 15-236 Frankfurt(Oder), Germany

transistors (FET) because of its high permittivity and good thermodynamic stability in contact with silicon. However, ZrO₂ crystallizes at temperatures below 400°C seriously limiting applications of the materials in ultra large-scale integrated (ULSI) circuits from a storage point of view. In this work, carbon-doped ZrO₂ thin films were fabricated on n-type Si (100) wafers by hybrid cathodic arc deposition involving oxygen and ethane gases in the presence of substrate biasing. The interfacial and dielectric properties of the materials were investigated. Incorporation of C into the ZrO₂ structure increases the crystallization temperature, and the microstructure of the carbonized ZrO₂ thin films is improved based on X-ray diffraction and atomic force microscopy characterization. In particular, formation of interfacial silicates between the ZrO₂ thin film and Si substrate is well suppressed according to the results of FTIR and HRTEM. The suppression is believed to stem from carbonization in conjunction with substrate biasing which can increase the number of bombarding ions as well as the ion impact energy thereby improving the interfacial properties. An Au/ZrO₂/Si/Al capacitor structure was fabricated and the electrical characteristics were measured. The hysteresis of the carbon-doped ZrO₂ thin films is reduced significantly and a negligible flatband shift is also observed. At the same time, there is no degradation in the dielectric constant and the leakage current density is significantly reduced. Our study suggests that a hybrid cathodic arc deposition process conducted in the presence of ethane in conjunction with substrate biasing is an effective method to improve the properties of high-k ZrO₂ thin films and may accelerate the development of alternative high-k dielectric thin films in advanced microelectronic devices and structures.
(close full abstract)

L 4b poster
00 16:15

Title : Conduction mechanisms and trapping in sputtered HfO₂ films

(view full abstract)

L 4b poster
00 16:15

Title : EPR characterization of defects in monoclinic powders of ZrO₂ and HfO₂

(view full abstract)

L 4b poster
00 16:15

Title : Low-Temperature Conductance Measurements of Surface States in HfO₂-Si Structures with Different Gate Materials

(view full abstract)

L 4b poster
00 16:15

Title : Interfacial Reactions between High-k Praseodymium Aluminate and TiN

(view full abstract)

L 4b poster
00 16:15

Title : Electrical and interfacial characteristics of nanolaminate (Al₂O₃/ZrO₂/Al₂O₃) gate stack on fully-depleted SiGe-on-insulator

Zengfeng dizengfeng, Zengfeng Di (a), Miao Zhang, Weili Liu, Qinwo Shen, Suhua Luo (a), Zhitang Song, Chenglu Lin The Research Center of Semiconductor Functional Film Engineering Technology & State Key Laboratory of Functional Materials for Informatics, Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences (CAS), Shanghai 200050, People's Republic of China Anping Huang, and Paul K. Chu (b) Department of Physics and Material Science, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, China (a) Also affiliated with Department of Physics & Materials Science, City University of Hong Kong, Hong Kong, China (b) Corresponding author: Prof. Paul K Chu Telephone: 852-27887724 Fax: 852-27889549 or 852-27887830 Electronic mail: paul.chu@cityu.edu.hk

Resume : The structural and electrical characteristics of a novel nanolaminate Al₂O₃/ZrO₂/Al₂O₃ high-k gate stack together with the interfacial layer formed on SiGe-on-insulator substrate have been investigated. A clear layered Al₂O₃ (2.5 nm) / ZrO₂ (4.5 nm) / Al₂O₃ (2.5 nm) structure and an interfacial layer (2.5 nm) are observed by

high-resolution transmission electron microscopy. X-ray photoelectron spectroscopy measurements indicate that the annealed interfacial layer contains Al silicate without Ge suboxides or GeO₂ incorporation. A well-behaved C-V behavior with no hysteresis shows the absence of Ge pileup or Ge segregation at the gate stack/SiGe interface after annealing.

(close full abstract)

L 4b poster
00 16:15

Title : The effect of quenching media on the surface heat transfer coefficient of electronic materials

(view full abstract)

L 4b poster
00 16:15

Title : Point defects in dielectrics based on Pr oxides

(view full abstract)

L 4b poster
00 16:15

Title : Praseodymium silicate high-k dielectrics

(view full abstract)

L 4b poster
00 16:15

Title : Investigation of Strontium Tantalate Thin Films for High-K Gate Dielectric Applications

(view full abstract)

L 4b poster
00 16:15

Title : Photoelectron spectroscopy (XPS) and photoelectron diffraction (XPD) studies on the system hafnium silicide and hafnium oxide on Si(100)

(view full abstract)

L 4b poster
00 16:15

Title : Structure analysis of the System Hafnium/Silicon(100) by means of X-ray photoelectron spectroscopy and X-ray photoelectron diffraction (XPD)

(view full abstract)

L 4b poster
00 16:15

Title : Investigation of interface defects and bulk charges in metal gate HfO₂ MOSFETs

(view full abstract)

L 4b poster
00 16:15

Title : Carrier transport and related phenomena in MOS devices

(view full abstract)

L poster
00 16:15

Title : Structure and electrical properties of low pressure MOCVD-grown Yb₂O₃ films on Si(100)

(view full abstract)

L 4b poster
00 16:15

Title : Embedded cluster model for the ab initio study of the electronic structure and properties of charged defects in HfO₂

(view full abstract)

L 4b poster
00 16:15

Title : Conditions and Memory Properties of Charge Traps in Si-rich SiN_x films

(view full abstract)

L 4b poster
00 16:30

Title : Recovery of plasma induced damage in (Ba,Sr)TiO₃ thin films etching for next generation device

(view full abstract)

L 4b poster
00 16:30

Title : Etch damage evaluation on (Bi_{4-x}La_x)Ti₃O₁₂ thin films during the etch process using inductively coupled plasma sources

(view full abstract)

31/05/2006

L 5a invited
00 14:00

Title : Material Challenge to Higher-k Dielectrics

(view full abstract)

L 5a
00 14:30

Title : Structural and Vibrational properties of high-dielectric oxides HfO₂ and TiO₂: a comparative study

(view full abstract)

L 5a
00 14:45

Title : Impact of the HfO₂ crystallinity on wet etching

(view full abstract)