
Atomic Layer Deposition Applications 8

Editors:

J. W. Elam

Argonne National Laboratory
Argonne, Illinois, USA

S. De Gendt

imec
Leuven, Belgium

A. Londergan

Qualcomm MEMS Technologies
San Jose, California, USA

S. F. Bent

Stanford University
Stanford, California, USA

O. van der Straten

IBM Research
Albany, New York, USA

A. Delabie

imec
Leuven, Belgium

F. Roozeboom

Eindhoven University of Technology,
and TNO Eindhoven
Eindhoven, The Netherlands

Sponsoring Divisions:



Dielectric Science & Technology



Electronics and Photonics



Published by

The Electrochemical Society

65 South Main Street, Building D
Pennington, NJ 08534-2839, USA

tel 609 737 1902

fax 609 737 2743

www.electrochem.org

ecs transactions™

Vol. 50, No. 13

Copyright 2012 by The Electrochemical Society.
All rights reserved.

This book has been registered with Copyright Clearance Center.
For further information, please contact the Copyright Clearance Center,
Salem, Massachusetts.

Published by:

The Electrochemical Society
65 South Main Street
Pennington, New Jersey 08534-2839, USA

Telephone 609.737.1902
Fax 609.737.2743
e-mail: ecs@electrochem.org
Web: www.electrochem.org

ISSN 1938-6737 (online)
ISSN 1938-5862 (print)
ISSN 2151-2051 (cd-rom)

ISBN 978-1-62332-012-6 (PDF)
ISBN 978-1-60768-361-2 (Softcover)

Printed in the United States of America.

ECS Transactions, Volume 50, Issue 13
Atomic Layer Deposition Applications 8

Table of Contents

<i>Preface</i>	<i>iii</i>
----------------	------------

**Chapter 1
General Session**

Fabrication of Sb ₂ Te ₃ and Bi ₂ Te ₃ Multilayer Composite Films by Atomic Layer Deposition	3
<i>K. Zhang, D. Nminibapiel, M. Tangirala, H. Baumgart, and V. Kochergin</i>	

Trimethylaluminum-Based Atomic Layer Deposition of MO ₂ (M=Zr, Hf) Gate Dielectrics on In _{0.53} Ga _{0.47} As(001) Substrates	11
<i>A. Molle, E. Cianci, A. Lamperti, C. Wiemer, S. Baldovino, L. Lamagna, S. Spiga, M. Fanciulli, G. Brammertz, C. Merckling, and M. Caymax</i>	

**Chapter 2
Reaction Mechanisms**

Ion Bombardment during Plasma-Assisted Atomic Layer Deposition	23
<i>H. B. Profijt and W. Kessels</i>	

In Situ Study of ALD Processes Using Synchrotron-based X-ray Fluorescence and Scattering Techniques	35
<i>J. Dendooven, K. Devloo-Casier, M. Ide, K. Grandfield, K. F. Ludwig, S. Bals, P. Van Der Voort, and C. Detavernier</i>	

In Situ FTIR Characterization of Growth Inhibition in Atomic Layer Deposition Using Reversible Surface Functionalization	43
<i>A. Yanguas-Gil, J. A. Libera, and J. W. Elam</i>	

Solution Reactivity Studies for Identification of Promising New ALD and Pulsed CVD Reaction Chemistries	53
<i>B. Vidjayacoumar, V. Ramalingam, D. J. Emslie, J. Blackwell, and S. Clendenning</i>	

Chapter 3 Oxides

Crystallization Study by Transmission Electron Microscopy of SrTiO ₃ Thin Films Prepared by Plasma-Assisted ALD <i>V. Longo, F. Roozeboom, W. Kessels, and M. A. Verheijen</i>	69
TiO ₂ -Based Metal-Insulator-Metal Structures for Future DRAM Storage Capacitors <i>K. Fröhlich, B. Hudec, M. Čapajna, K. Hušeková, A. Rosová, P. Eliáš, J. Aarik, R. Rammula, A. Kasikov, T. Arroval, L. Aarik, K. Murakami, M. Rommel, and A. J. Bauer</i>	79
Plasma Surface Modification of Blown Polyethylene Films for Uniform Atomic Layer Deposition of Al ₂ O ₃ <i>G. Lee, K. Son, S. Park, J. Shim, and B. Choi</i>	89
Room-Temperature ALD of Metal Oxide Thin Films by Energy-Enhanced ALD <i>S. E. Potts, H. B. Profijt, R. Roelofs, and W. Kessels</i>	93

Chapter 4 Energy

Growth Characteristics and Properties of Yttrium Oxide Thin Films by Atomic Layer Deposition from Novel Y(iPrCp) ₃ Precursor and O ₃ <i>R. Xu, S. Selvaraj, N. Azimi, and C. G. Takoudis</i>	107
Electrocatalytic Activity of Pt Grown by ALD on Carbon Nanotubes for Si-Based DMFC Applications <i>A. Johansson, B. Dalslet, R. Yang, K. Haugshøj, M. Mølgaard, K. Christiansen, L. H. Christensen, and E. V. Thomsen</i>	117
High Performance Core-Shell Nanowire Array Devices Prepared by Atomic Layer Deposition <i>H. Kim, K. Ko, and H. Kang</i>	127

Chapter 5 Novel Applications

Metal Oxide ALD Films for Low Power Sensor Applications <i>M. A. Blauw, V. T. Dam, M. Crego Calama, and S. H. Brongersma</i>	137
Enabling High Performance Mirrors for Astronomy with ALD <i>F. Greer, M. C. Lee, S. Nikzad, W. Traub, and M. Beasley</i>	141

Chapter 6

Metals

Atomic Layer Deposition of TiN/Al ₂ O ₃ /TiN Nanolaminates for Capacitor Applications <i>L. Assaud, M. Hanbücken, and L. Santinacci</i>	151
--	-----

Impact of Direct Plasma Densification on Resistivity and Conformality of PEALD Tantalum Nitride <i>O. van der Straten, X. Zhang, C. Penny, J. Maniscalco, S. Chiang, J. Ren, and P. Ma</i>	159
--	-----

Atomic Layer Deposition of Ruthenium in Various Precursors and Oxygen Doses <i>J. Kim, K. Son, B. Kim, W. Kim, and J. Shim</i>	165
---	-----

Chapter 7

Poster Session

Synthesis of VO ₂ Thin Films by Atomic Layer Deposition with TEMA V as Precursor <i>K. Zhang, M. Tangirala, D. Nminibapiel, W. Cao, V. Pallem, C. Dussarrat, and H. Baumgart</i>	175
--	-----

Author Index	183
--------------	-----