7th Annual SEMATECH Symposium Japan 2011

Tokyo, Japan
22 June 2011

ISBN: 978-1-61839-385-2

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571

Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2011) by SEMATECH
All rights reserved.

Printed by Curran Associates, Inc. (2012)

For permission requests, please contact SEMATECH
at the address below.

SEMATECH
2706 Montopolis Drive
Austin, Texas 78741

Phone: (512) 356-3500
Fax: (512) 356-7848

www.sematech.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

PLENARY SESSION

Technology and Manufacturing Innovations: New SEMATECH Initiatives 1
Daniel Armbrust
Supply Chain Management in Electronics Industry 39
Akira Minamikawa
More than Moore or More Moore: A SWOT Analysis 68
G. Dan Hutcheson

PUSHING THE PATTERNING LIMITS: ADVANCES IN EUV LITHOGRAPHY

EUVL Development at SEMATECH 100
Bryan Rice
EUV Photoresist Development 122
Shinji Tarutani
EUVL Mask: Progress and Challenges 148
Naoya Hayashi
EUV LDP Sources: Status and Roadmap 161
Kunihiko Kasama
EUV Resist Development at TOK 183
Jun Iwashita
EUV Lithography into Production at Chipmakers: Update on ASML's NXE Platform 199
Junji Miyazaki
The EUV Puzzle .... N/A
Gilroy Vandentop

CMOS SCALING: IT'S A 3D WORLD!

Development of 32nm CMOS and Recent Trends for Beyond 32nm 220
Masaaki Niwa
Towards 3-dimensional CMOS Scaling 274
Kah-Wee Ang
3D CMOS Devices - Why Do We Need Them and Challenges .... N/A
Tetsuo Endoh
High Mobility Ge Devices as Alternative to Si 318
Akira Toriumi
III-V CMOS 344
R. Hill, C. Park, W. Loh, J. Barnett, J. Huang, J. Oh, N. Goel, C. Hobbs, P. Kirsch, R. Jammy

ACCELERATING MOMENTUM: INNOVATION AND COLLABORATION IN THE 450 MM TRANSITION

450 mm: Progress, Plans, and Strategy 379
Tom Abell
450 mm Wafer Handling / Carrier Development .... N/A
Poshin Lee
Bare Wafer Particle Inspection for 450 mm .... N/A
Kazunori Nemoto
450 mm LPCVD Equipment Preparedness and Process Readiness of Eugene Technology 405
Scott Youn
450 mm Scalability of Plasma-enhanced CVD and ALD 421
Nobuyoshi Kobayashi

SAFE AND ROBUST QUALIFICATIONS: INTELLIGENT STATISTICAL METHODS

Intelligent Statistical Methods for Safer and More Robust Qualifications 436
Wayne J. Levin

REALIZING THE POTENTIAL: DRIVING 3D INTO MAINSTREAM MANUFACTURING

Overview of ITRI's TSV Technology 513
M. J. Tsai
3D TSV Interconnects – SEMATECH 552
Sitaram Arkalgud
TSV Wafer Thinning 565
Eiichi Yamamoto
Current Status of Packaging Materials for 3D Integration .... N/A
Hitoshi Kawaguchi
Low-Temperature Homo/Heterogeneous Bonding in Ambient Air for Future 3D-TSV 588
Akitsu Shigetou
3D Enablement Center 598
Larry Smith

EMERGING TECHNOLOGIES: IT'S A SMART, DENSE, FUNCTIONAL WORLD!

Non-charge Storage Resistive Memory: How It Works 617
Gennadi Bersuker
Recent Advances and Prospects in ReRAM Technology: Smart Electronics Application of Functional Oxides 640
Hiro Akinaga
CMOS Scaling Beyond FinFETs: Nanowires and TFETs 662
Chris Hobbs, Wei-Yip Loh, Kerem Akarvardar, Paul Kirsch, Raj Jammy
Functional NEMS 693
Elad Alon, Tsu-Jae King Liu, Vladimir Stojanovic, Dejan Markovi?, Chanro Park, Rinus Lee, Wei-Yip Loh

THE INDUSTRY'S ENABLER: PERSPECTIVES ON METROLOGY CHALLENGES

Metrology Program Overview 713
Phil Bryson
Toshiba Top 5 Metrology Perspectives .... N/A
Yuuichiro Yamazaki
Fujitsu Top 5 Metrology Perspectives 725
Eiichi Kawamura
SEMATECH 3D Interconnect Top 5 Metrology Challenges 739
Larry Smith
SEMATECH Lithography Top 5 Metrology Challenges 755
Bryan Rice
SEMATECH FEP Top 5 Metrology Challenges 766
Kah-Wee Ang
Panel Discussion: Supplier Community Perspectives on These Challenges .... N/A
Takeshi Kato, Kazuhiko Omote, DongSub Choi

COLLABORATION IN MANUFACTURING: THE DIFFUSION OF INNOVATION

The Diffusion of Innovation 781
Sanjay Rajguru
ISMI's Latest Initiative: The Mature Technology Fab Program 791
Moritaka Nakamura
Equipment Productivity Forums: Collaboration for Equipment Productivity Gains 815
Boyd Finlay
ESH Focus on Manufacturing 830
Steve Trammell
Prognostics and Health Management (PHM) in Semiconductor Manufacturing 858
David Stark
Author Index