



**16<sup>th</sup> IEEE International Conference on  
Advanced Thermal Processing of  
Semiconductors**

**RTP 2008**

**September 30- October 3, 2008  
The Platinum Hotel and Spa, Las Vegas, NV**

## Tuesday, September 30, 2008

9:00AM-5:00PM

### Workshop

#### **Strain-Enhanced Mobility and Advanced Channel Materials**

##### **Basic Strain Physics**

Shu-Tong Chang, National Chung Hsing University  
Chee Wee Liu, National Taiwan University

##### **Channel Strain Engineering for High Performance CMOS Technology**

Hasan M. Nayfeh  
IBM - Semiconductor Research & Development Center, Hopewell Junction, NY

##### **Strained Si/Ge Heterostructures: SiGe Virtual Substrate and Strained Ge Channel**

Kentarou Sawano, Musashi Institute of Technology, Tokyo, Japan

##### **Source and Drain Salicidation for Advanced CMOS Technology : SiGe, Si:C, Ge and sSi-based devices**

Veronique Carron, CAE/LETI, Grenoble, France

##### **High Mobility Channels with Performance Enhancement Process Options**

Raj Jammy, SEMATECH, Austin

## Wednesday, October 1, 2008

### **Plenary Session**

Chairs: Jeff Gelpey, Mattson Technology, Bruce Adams, Applied Materials

8:00AM-8:15AM

Conference Opening

8:15AM-9:00AM Keynote Address

#### **Recent Advances in Stress and Activation Engineering for High-Performance SOI Logic Transistors**

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T. Feudel, M. Horstmann, AMD Saxony LLC & Co. KG

9:00AM-9:45AM Invited Presentation

#### **High-Performance Bulk CMOS Technology with Millisecond Annealing and Strained Si**

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T. Sugii, K. Ikeda, T. Miyashita, FUJITSU Laboratories LTD.

9:45AM-10:30AM Invited Presentation

#### **New Metrologies for Annealing of USJs and Thin Films**

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M. I. Current, Frontier Semiconductor, J. O. Borland, J.O.B. Technologies

10:30AM-11:15AM

**Laser Spike Annealing and its Application to Leading-edge Logic Devices**

57

Y. Wang, S. Chen, M. Schen, X. Wang, S. Zhou, A. Hawryluk, J. Hebb, D. Owen  
Ultratech, San Jose, CA

11:15AM-12:00PM

**Optimization of Diffusion, Activation and Damage Annealing  
in Millisecond Annealing**

65

P. J. Timans<sup>1</sup>, Yao Zhi Hu<sup>1</sup>, J. Gelpey<sup>2</sup>, S. McCoy<sup>2</sup>,  
W. Lerch<sup>3</sup>, S. Paul<sup>3</sup>, D. Bolze<sup>4</sup>, H. Kheyrandish<sup>5</sup>, J. Reyes<sup>6</sup>, S. Prussin<sup>6</sup>

<sup>1</sup>Mattson Technology, Inc., Fremont, California, USA

<sup>2</sup>Mattson Technology Canada, Inc., Vancouver, Canada

<sup>3</sup>Mattson Thermal Products GmbH, Dornstadt, Germany

<sup>4</sup>IHP, Frankfurt (Oder), Germany

<sup>5</sup>CSMA Ltd., Stoke-on-Trent, UK

<sup>6</sup>University of California, Los Angeles, CA

12:00-1:00PM Lunch Break

1:00PM-1:30PM

**Effect of Wafer Thickness on Sheet Resistance During Spike Anneal**

89

S. Catlett, J. F. Shepard, Jr.

IBM 300mm Manufacturing, Hopewell Junction, NY

1:30PM-2:00PM

**Ellipsometry of Ion Implantation Induced Damage**

93

P. Petrik, T. Lohner, O. Polgár, M. Fried

Research Institute for Technical Physics and Materials Science, Budapest, Hungary

2:00PM-2:15PM Coffee Break

2:15PM-2:45PM

**Optical Interference Effect on Chip's Temperature Distribution  
in the Optical Annealing Process**

103

H. Ohno<sup>1</sup>, T. Itani<sup>2</sup>, H. Yoshinori<sup>1</sup>

<sup>1</sup>Corporate Research and Development Center, Toshiba Corporation

<sup>2</sup>Process Manufacturing Engineering Center, Toshiba Corporation

2:45PM-3:15PM

**Annealing Behavior of ClusterCarbon™ Implants**

107

W. Krull, K. Sekar

SemEquip, Billerica, MA

J. Chan, S. McCoy, J. Gelpey

Mattson Technology Canada, Vancouver, Canada

3:15PM-3:45PM

**Plasma Doping Control by Mass Metrology**

113

J-L. Everaert<sup>1</sup>, G. Zschaetzsch<sup>1</sup>, E. Vecchio<sup>1</sup>, W. Vandervorst<sup>1,2</sup>, L. Cunnane<sup>3</sup>

<sup>1</sup>IMEC, Leuven, Belgium

<sup>2</sup>Instituut voor Kern-en Stralingsfysika, K.U. Leuven, Belgium

<sup>3</sup>Metryx Ltd., Bristol UK

3:45PM-4:15PM

**Temperature Measurement in RTP: Past and Future**

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B. Adams, Applied Materials, Santa Clara, CA

7:00PM

**Banquet and Achievement Award Ceremony**

**Thursday, October 2, 2008**

**Laser Processing**

Chairs: Andrew Hawryluk, Ultratech, Julien Venturini, Excico

9:00AM-9:30AM

**Characterization of Deformation Induced by Micro-Second Laser Anneal Using CGS Interferometry**

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D. M. Owen, Y. Wang, A. Hawryluk, S. Zhou, J. Hebb  
Ultratech Inc., San Jose, CA

9:30AM-10:00AM

**Impact of Multiple Sub-melt Laser Scans on the Activation and Diffusion of Shallow Boron Junctions**

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E. Rosseela, W. Vandervorsta,<sup>2</sup> T. Claryssea, J. Goossensa, A. Moussaa  
R. Linc, D.H. Petersenc,<sup>5</sup> P.F. Nielsenc, O. Hansend, N.S. Bennette, N.E.B. Cowerne<sup>5</sup>  
<sup>1</sup>IMEC, Leuven, Belgium  
<sup>2</sup>KU Leuven, Dept. of Physics-IKS, Leuven, Belgium  
<sup>3</sup>Capres A/S, Scion-DTU, Kongens Lyngby, Denmark  
<sup>4</sup>DTU Nanotech - Dept. of Micro and Nanotechnology,  
Technical University of Denmark, Lyngby, Denmark  
<sup>5</sup>School of Electrical, Electronic and Computer Engineering,  
University of Newcastle upon Tyne, Newcastle upon Tyne, UK

10:00AM-10:30AM

**Ultra Shallow Doping by Excimer laser Drive-In of RPCVD Surface Deposited Arsenic Monolayers**

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M. Popadic, Lis K. Nanver, C. Biasotto, V. Gonda, J. van der Cingel  
Laboratory of ECTM, DIMES, Delft University of Technology, The Netherlands

10:30AM-11:00AM

**Enhancing Tensile Stress and Source/Drain Activation with Si:C with Innovations in Ion Implant and Millisecond Laser Spike Annealing**

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H. Maynard, C. Hatem, H.-J. Gossmann, Y. Erokhin, N. Variam  
Varian Semiconductor Equipment Associates, Gloucester, MA  
S. Chen, Y. Wang  
Ultratech Inc. San Jose, CA

11:00AM-11:30AM

**Emission Feedback Control System for Sub-Millisecond Laser Spike Anneal** 157

J. T. McWhirter, D. Gaines, P. Zambon,  
Ultratech Incorporated, San Jose, California

11:30AM-12:00PM

**Control of Laser Induced Interface Traps with In-line Corona Charge Metrology** 163

J-L. Everaert<sup>1</sup>, E. Rosseel<sup>1</sup>, C. Ortolland<sup>1</sup>, M. Aoulaiche<sup>1</sup>, T.Hoffmann<sup>1</sup>,  
T. Pavelka<sup>2</sup>, E. Don<sup>3</sup>

<sup>1</sup>IMEC, Leuven, Belgium

<sup>2</sup>Semilab, Budapest, Hungary

<sup>3</sup>SemiMetrics Ltd., Kings Langley, UK

12:00-1:00PM Lunch Break

## **Laser and Millisecond Processing**

Chairs: Vittorio Privitera, IMM-CNR, Paul Timans, Mattson Technology

1:00PM-1:30PM

**Free Form Microlens Systems Enable New Laser Beam Profiles for RTP** 169

D. Hauschild, P. Harten, L. Aschke, V. Lissotschenko  
LIMO Lissotschenko Mikrooptik GmbH, Dortmund, Germany

1:30PM-2:00PM

**Laser Annealing of Double Implanted layers for IGBT Power Devices** 177

C. Sabatier, S. Rack, H. Beseaucèle, J. Venturini

Excico, Gennevilliers, France

T. Y. Hoffmann, E. Rosseel, J. Steenbergen

IMEC, Leuven Belgium

2:00PM-2:15PM Coffee Break

2:15PM-2:45PM

**Origins of Local Temperature Variation During Spike Anneal and Millisecond Anneal** 183

R. Beneyton<sup>1</sup>, A. Colin<sup>1,2</sup>, H. Bono<sup>1,3</sup>, F. Cacho<sup>1</sup>, M. Bidaud<sup>1</sup>,

B. Dumont<sup>1</sup>, P. Morin<sup>1</sup>, K. Barla<sup>1</sup>

<sup>1</sup>ST Microelectronics, Crolles Cedex, FRANCE

<sup>2</sup>InESS (CNRS/Université Louis Pasteur) Strasbourg, France

<sup>3</sup>CEA LETI Grenoble, FRANCE

2:45PM-3:15PM

**Total Temperature Fluctuation of a Pattern Wafer in Millisecond Annealing** 195

T. Kubo, T. Sukegawa, M. Kase

Fujitsu Microelectronics Ltd.

3:15PM-3:45PM

**Low temperature Microwave Annealing of S/D** 201

B. Lojek

ATMEL Corporation, Colorado Springs, CO

Friday, October 3, 2008

## Advanced Thermal Processing

Chairs: Kyoichi Suguro, Toshiba, Thomas Feudel, AMD

9:00AM-9:30AM

### **Wavelength and Polarization Dependent Absorption Effects in Millisecond Annealing of Metal Gate Structures** 211

D. P. Ceperley, A. R. Neureuther

Dept. of Electrical Engineering and Computer Sciences, Univ. of California, Berkeley

A. Hawryluk, X. Wang, M. Shen, Y. Wang

Ultratech, San Jose, CA

9:30AM-10:00AM

### **Si Surface Preparation and Passivation by Heavy Water Vapor** 219

Andrea Edit Pap<sup>1</sup>, P. Petrik<sup>1</sup>, B. Pecz<sup>1</sup>, G. Battistig<sup>1</sup>, I. Bársony<sup>1</sup>,  
Z. Nényei<sup>2</sup>, Z. Szekrenyes<sup>3</sup>, K. Kamarás<sup>3</sup>, Z. Schay<sup>4</sup>

<sup>1</sup>Research Institute for Technical Physics and Materials Science MFA,  
Hungarian Academy of Sciences, Budapest, Hungary

<sup>2</sup>Mattson Thermal Products, Dornstadt, Germany

<sup>3</sup>Research Institute for Solid State Physics and Optics SZFKI,  
Hungarian Academy of Sciences, Budapest, Hungary

<sup>4</sup>Research Institute of Isotopes

Hungarian Academy of Sciences, Budapest, Hungary

10:00AM-10:30AM

### **Quality and Reliability of Oxide by Low Thermal Budget Rapid Thermal Oxidation** 229

Y. Cho, Y. Yokota, C. Olsen, A. Tjandra, Kai Ma, V. Nguyen  
Applied Materials, Santa Clara, CA

10:30AM-11:00AM

### **Thermal and Non-thermal Kinetics of Defect and Dopant in Si** 235

A. La Magna, G. Fisicaro, G. Mannino and V. Privitera

CNR-IMM, Catania, Italy

G. Piccitto

Department of Physics and Astronomy, University of Catania, Catania, Italy

B. G. Svensson and L. Vines

Department of Physics, Physical Electronics, University of Oslo, Oslo, Norway

11:00AM-11:30AM

### **Parasitic Resistance and Leakage Reduction by Raised Source/Drain Extension Fabricated with Cluster Ion Implantation and Millisecond Annealing** 241

K. Yako<sup>1</sup>, T. Yamamoto<sup>1</sup>, K. Uejima<sup>1</sup>, T. Ikezawa<sup>2</sup>, M. Hane<sup>1</sup>

<sup>1</sup>LSI Fundamental Research Laboratory, NEC Electronics Corporation

<sup>2</sup>NEC Informatec Systems, Ltd., Sagami-hara-city, Kanagawa, Japan

11:30AM-12:00PM

**RTA and FLA of Ultra-Shallow Implanted Layers in Ge**

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C. Wündisch, M. Posselt, W. Anwand, B. Schmidt, R. Grötzschel,  
A. Mücklich, S. Gemming, W. Skorupa  
Forschungszentrum Dresden-Rossendorf,  
Institute of Ion Beam Physics and Materials Research, Dresden, Germany  
T. Clarysse, E. Simoen, A. Satta  
IMEC, Leuven, Belgium  
H. Hortenbach, U. Mühle  
Qimonda Dresden GmbH & Co OHG;  
Fraunhofer-Center Nanoelektronische Technologien (CNT), Dresden, Germany  
A. Lenk  
Triebenberg Laboratory, Institute of Structure Physics, TU Dresden, Dresden, Germany

12:00-1:00PM Lunch Break

**Metrology and Equipment**

Chairs: Michael Current, Frontier Semiconductor, Aaron Hunter, Applied Materials

1:00PM-1:30PM

**High Precision Micro-Scale Hall Effect Characterization Method  
using in-line Micro Four-Point Probes**

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D.H. Petersen<sup>1,2</sup>, O. Hansen<sup>2,3</sup>, T. Clarysse<sup>4</sup>, J. Goossens<sup>4</sup>, E. Rosseel<sup>4</sup>,  
W. Vandervorst<sup>4,5</sup>, R. Lin<sup>2</sup>, P.F. Nielsen<sup>2</sup>

<sup>1</sup>DTU Nanotech - Dept. of Micro and Nanotechnology,  
Technical University of Denmark, Lyngby, Denmark

<sup>2</sup>CAPRES A/S, Lyngby, Denmark

<sup>3</sup>CINF - Centre for Individual Nanoparticle Functionality,  
Technical University of Denmark, Lyngby, Denmark

<sup>4</sup>IMEC, Leuven, Belgium

<sup>5</sup>KU Leuven, Dept. of Physics-IKS, Leuven, Belgium

1:30PM-2:00PM

**Si Spontaneous Emission During RTP and its Impact on  
Low-Temperature Pyrometry**

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J.P. Li, A. Hunter, R. Ramanujam  
Applied Materials, Santa Clara, CA

2:00PM-2:15PM Coffee Break

2:15PM-2:45PM

**The Heating Component of RTP System**

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Yuan Junjie, He Guangping, Yin Jiying  
College of Mechanical Electrical and Engineering,  
North China University of Technology, No.5  
Jinyuanzhuang Road, Shijingshan District, Beijing, P.R. China

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**Dynamic Wafer Temperature Measurement in Conduction-Based RTP Systems** 263

E. Granneman<sup>1</sup>, X. Pagès<sup>2</sup>, P. Vermont<sup>2</sup>

<sup>1</sup>ASM Europe B.V., Almere, The Netherlands

<sup>2</sup>ASM France, Grenoble, France

3:15PM-3:45PM

**Investigation of Microwave Annealed Implanted Layers with  
TWIN Metrology System** 273

B. Lojek, Atmel Corporation, Colorado Springs, CO

H. D. Geiler, JenaWave GmbH, Jena, Germany