The abstracts reproduced here are for the use of SISC attendees. To encourage future participants to submit new, unpublished work, the conference policy is that the abstracts may not be referenced.
30th IEEE
Semiconductor Interface Specialists Conference

December 2 – 4, 1999
Mills House Hotel, Charleston, South Carolina

Executive Committee

Dan Fleetwood, General Chair
Vanderbilt University
Nashville, TN USA

Beall Fowler, Technical Program Chair
Lehigh University
Bethlehem, PA USA

Kathleen S. Krisch, Local Arrangements Chair
Bell Labs – Lucent Technologies
Murray Hill, NJ USA

Len Trombetta, Ex-Officio
University of Houston
Houston, TX USA

Program Committee:

Robert Buhrman
Cornell University, Ithaca, NY USA

Eduard Cartier
IBM Watson Center, Yorktown Hts., NY USA

Robin Degraeve
IMEC, Leuven, Belgium

Gerard Ghibaudo
LPCS/ENSERG, Grenoble, France

Evgeni Gusev
IBM Watson Center, Yorktown Hts., NY USA

Masataka Hirose
Hiroshima Univ., Higashi-Hiroshima, Japan

Taishi Kubota
NEC, Kanagawa, Japan

Lori Lipkin
Cree Research, Durham, NC USA

Gerry Lucovsky
North Carolina State Univ., Raleigh, NC USA

Yi Ma
Lucent Technologies, Orlando, FL USA

Bich-Yen Nguyen
Motorola, Austin, TX USA

Yasushiro Nishioka
Texas Instruments, Tsukuba, Japan

Nelson Saks
Naval Research Lab., Washington, DC USA

Jordi Suñé
Univ. Autónoma at Barcelona, Bellaterra, Spain

Michael Uren
DERA, Malvern, UK

Karel Vanheusden
Air Force Res. Lab., Albuquerque, NM USA

Robert Wallace
Univ. of North Texas, Denton, TX USA

Mary Ellen Zvanut
UA – Birmingham, Birmingham, AL USA
SISC Ed Nicollian Award for Best Student Paper

In 1995 the SISC began presenting an award to the best student presentation of the SISC in honor of Professor E. H. Nicollian, University of North Carolina at Charlotte. Professor Nicollian was a pioneer in the exploration of the metal-oxide-semiconductor system, particularly in the area of electrical measurements. His efforts were fundamental to establishing the SISC in its early years, and he served as its technical program chair in 1982. With John Brews, he wrote the definitive book, "MOS Physics and Technology," published by Wiley Interscience.

The SISC Ed Nicollian Award for Best Student Paper is presented to the lead student author of either an oral or poster presentation. The winner is chosen at the end of the SISC by members of the technical program committee. The award consists of a plaque and an honorarium sent to the winner after the Conference. To honor the winner, the award is announced at the conference taking place the following year.

The 1998 SISC Ed Nicollian Award for Best Student Paper was given to Mrinal K. Das of Purdue University, U. S., for his paper entitled Inversion Channel Mobility in 4H- and 6H-SiC MOSFETs. Co-authors on the paper are J. A. Cooper, Jr., M. R. Melloch, and M. A. Capano, also of Purdue University.

Those eligible and wishing to be considered for the 1999 SISC Ed Nicollian Award for Best Student Paper should contact the 1999 IEEE SISC Executive Committee.
30th IEEE
Semiconductor Interface Specialists Conference
December 2-4, 1999
Mills House Hotel, Charleston, South Carolina

Wednesday, Dec. 1
Conference Registration 4 PM - 9 PM  Hotel Lobby
Hospitality Suite 8 PM - 12 AM  Presidential Suite

Thursday, Dec. 2
Continental Breakfast 7:15 AM  Queen St. Gallery
Conference Registration 7:15AM-5:30 PM  Queen St. Gallery
Poster Set-Up Available 8 AM - 5 PM  Middleton Room
Session 1: Alternative Dielectrics I 8:00 AM  Signers Ballroom
Morning Break 9:40 AM  Queen St. Gallery
Session 2: Alternative Dielectrics II 10:20 AM  Signers Ballroom
Poster Talks: P2.1 – P2.9 11:30 AM  Signers Ballroom
Lunch 12:00 PM
Poster Talks: P3.1-3.7 3:00 PM  Signers Ballroom
Afternoon Break 3:20 PM  Queen St. Gallery
Session 4: Silicon Carbide 4:00 PM  Signers Ballroom
Poster Talks: P4.1-P4.8 5:10 PM  Signers Ballroom
Adjourn 5:35 PM

Poster Presentations and Hors d’oeuvres 7 - 10 PM  Planters Suite
Hospitality Suite 9 PM - 12 AM  Presidential Suite

Friday, Dec. 3
Continental Breakfast 7:15 AM  Queen St. Gallery
Conference Registration 7:15AM-12:30 PM  Queen St. Gallery
Session 5: Breakdown I 8:00 AM  Signers Ballroom
Morning Break 10:10 AM  Queen St. Gallery
Session 6: Breakdown II 10:50 AM  Signers Ballroom
Adjourn 12:20 PM

Luncheon (for 1999 Program Committee and Invited Speakers Only) 12:30PM - 1:30 PM  Middleton Room
**Friday afternoon is unscheduled, with several optional events:**

Optional Rump Session on Alternative Dielectrics  2 PM - 4 PM  Middleton Room  
Optional Rump Session on Defects and Breakdown  2 PM - 4 PM  Presidential Suite  
Optional Tours of Local Attractions  Information available at SISC Reg. Desk  

**Champagne Reception**  7 PM – 7:30 PM  Queen St. Gallery  
**Conference Banquet* and Limerick Contest**  7:30 PM – 10 PM  Signers Ballroom  
**Meeting (1999/2000 Program Committees only)**  10 PM – 11 PM  Middleton Room  
**Hospitality Suite**  10 PM - 12 AM  Presidential Suite  
*Be sure you have told us your meal selection and notified us of any guests attending the banquet  

**Saturday, Dec. 4**  
Continental Breakfast  7:15 AM  Queen St. Gallery  
Conference Registration  7:15AM-12:30 PM  Queen St. Gallery  
**Session 7: Theory**  8:00 AM  Signers Ballroom  
Morning Break  9:50 AM  Queen St. Gallery  
**Session 8: Oxidation and Defects**  10:30 AM  Signers Ballroom  
Closing Remarks  12:20 PM  Signers Ballroom  
Adjourn  12:30 PM  

_The 2000 IEEE SISC will be held December 7-9, 2000 at the Catamaran Hotel, in San Diego, California._  
_We hope to see you there!_
Session 1 – Alternative Dielectrics I
Thursday, December 2, 1999
Session Chair: D. M. Fleetwood (Vanderbilt University)

8:00 AM Welcome and Opening Remarks

8:10 AM 1.1 *Invited* Tantalum Pentoxide (Ta$_2$O$_5$) as a Dielectric Film for Silicon-Based Devices C. Chaneihere and J. L. Autran (INSA-Lyon, France)

8:50 AM 1.2 Structure and Stability of Ultra-Thin Metal Oxide Dielectrics on Si(001), M. Copel, M. Gribelyuk and E. Gusev (IBM T. J. Watson Research Center)

9:10 AM 1.3 Interfacial and Electrical Properties of Gate-Quality Al$_2$O$_3$ Films on Silicon, J.-P. Han, L. Manchanda, A. Ghetti, Y. O. Kim, M. D. Morris, R. L. Opila, P. J. Silverman, and G. Weber (Bell Labs – Lucent Technologies)

9:30 AM Discussion

9:40 AM BREAK

Session 2 – Alternative Dielectrics II
Thursday, December 2, 1999
Session Chair: G. Ghibaudo (LPCS/ENSERG)

10:20 AM 2.1 Stable Hafnium and Zirconium Silicate Advanced Gate Dielectrics Directly on Si, G. D. Wilk and R. M. Wallace\(^1\) (Texas Instruments, \(^1\)Univ. of North Texas)

10:40 AM 2.2 Electrical Characteristics of Ultra-Thin Hafnium Oxide Gate Dielectric, Byoung Hun Lee, Laegu Kang, Wen-Jie Qi, Renee Nieh, Yongjoo Jeon, and Jack C. Lee (University of Texas)

11:00 AM 2.3 Optimization of Silicon Oxynitride Alloy Gate Stacks for Aggressively-Scaled CMOS Devices, Hanyang Yang and Gerald Lucovsky (North Carolina State University)

11:20 AM Discussion
Posters P2.1-P2.9
Thursday, December 2, 1999
Session Chair: G. Lucovsky (North Carolina State University),

11:30 AM P2.1 Temperature Dependence of Gate Current in Thin Ta_2O_5 and TiO_2 Films, Zhijiong Luo\(^1\), Zin Guo\(^2\), T. P. Ma\(^3\), and T. Tamagawa\(^4\) (\(^1\)Yale University, \(^2\)Jet Process Corporation)

11:33 AM P2.2 Analytical Spectroscopic Ellipsometry of Ta_2O_5 and TiO_2 for Use as High-k Gate Dielectrics, C. A. Richter\(^1\), N. V. Nguyen\(^1\), G. B. Alers\(^2\), Xin Guo\(^3\), Xiewen Wang\(^3\), T. P. Ma\(^3\), and Takashi Tamagawa\(^4\) (\(^1\)NIST, Gaithersburg, MD USA, \(^2\)Bell Labs – Lucent Technologies, \(^3\)Yale University, \(^4\)Jet Processes Corp.)

11:36 AM P2.3 Properties of 1.2 nm Hafnium Silicate as a Gate Dielectric on n- and p-Silicon, M. Kulkarni\(^1\), G. Heuss\(^1\), K. Smith\(^1\), H. Lazar\(^1\), W. Li\(^1\), V. Misra\(^1\), S. Pietambaram\(^2\) and V. Kaushik\(^2\) (\(^1\)North Carolina State Univ., \(^2\)Motorola)

11:39 AM P2.4 Electrical Properties and Reliability of Ultrathin Remote Plasma Enhanced CVD Si_3N_4 Layers, M. Houssa\(^1\), R. Degraeve\(^1\), C. Pomarede\(^2\), K. van Dijik\(^3\), C. Werkhoven\(^3\), P. W. Mertens\(^1\), M. M. Heyns\(^1\), and A. Stesmans\(^4\) (\(^1\)IMEC, \(^2\)ASM America, \(^3\)Katholieke Universiteit Leuven)

11:42 AM P2.5 PMOS and NMOS FETs with Aggressively-Scaled Oxide Equivalent Gate Dielectric Thickness to 1.3 nm with Oxide-Nitride ("ON") Stacked Dielectrics with Nitrided Interfaces ("NON") by Remote Plasma Oxidation, Interface Nitridation and Film Deposition Processes, Yider Wu, Yi-Mu Lee, and Gerald Lucovsky (North Carolina State University)

11:45 AM P2.6 Influence of the Nitridation Process (RTN/Furnace) on the (001) Si/Ultra Thin SiO_2 Interface Defects, J. L. Cantin and H. J. von Bardeleben (Universités Paris 6 & 7 et CNRS)

11:48 AM P2.7 SILC in Thin Oxides after Electrical or Radiation Stresses under Pulsed Voltage Conditions, A. Cester\(^1\), A. Paccagnella\(^1\), M. Ceschia\(^1\), G. Dosso\(^1\), and G. Ghidini\(^2\) (\(^1\)Univ. di Padova, \(^2\)ST Microelectronics, Italy)

11:51 AM P2.8 Temperature Dependence of Stress Induced Leakage Current in Ultra-Thin Oxides, M. Ceschia\(^1\), A. Paccagnella\(^1\), A. Cester\(^1\), L. Larcher\(^2\), and G. Ghidini\(^4\) (\(^1\)Univ. di Padova, \(^2\)Unità INFIM, \(^3\)Univ. di Modena e Reggio Emilia, \(^4\)SST Microelectronics, Italy)

11:54 AM P2.9 Physical Model and Characterization of Valence-Band-Tunneling-Induced Substrate Currents in N and PMOSFETs with 1.5-3.5 nm-thick Oxides, A. Shanware\(^1\), J. P. Shiely\(^1\), H. Z. Massoud\(^1\), E. Vogel\(^2\), K. Henson\(^2\), A. Srivastava\(^2\), C. Osburn\(^2\), J. R. Hauser\(^2\), and J. J. Wortman\(^2\) (\(^1\)Duke University, \(^2\)North Carolina State University)

11:57 AM LUNCH
Session 3 – Cleaning and Conduction
Thursday, December 2, 1999
Session Chair: Y. Ma (Lucent Technologies)

1:30 PM 3.1 Invited Surface Cleaning Issues in Thin-Oxide Technology  Paul Mertens (IMEC)

2:10 PM 3.2 Is It Reasonable to Assume Equilibrium Conditions for the Modeling of Ultrathin Oxide MOS Devices?, Jordi Sufi6 and Xavier Oriols (Universitat Autónoma de Barcelona)


2:50 PM Discussion

Posters P3.1-P3.7
Thursday, December 2, 1999
Session Chair: M. E. Zvanut (University of Alabama – Birmingham)

3:00 PM P3.1 Temperature Dependence of Channel Electron Mobility in 6H-SiC NMISFETs, W. J. Zhu, X. W. Wang, and T. P. Ma (Yale University)


3:06 PM P3.3 Accelerated Injection-Induced Degradation of Wet-Oxidized 4H-SiC MOS Structures, V. V. Afanas'ev and A. Stesmans (University of Leuven)


3:12 PM P3.5 Monitoring the Degradation of Sub-5nm Gate Oxides, J. Suñé, E. Miranda, R. Pau, R. Rodriquez, M. Nafria, and X. Aymerich (Univ. Autònoma de Barcelona)

3:15 PM P3.6 Electrical Imaging of SiO2 Breakdown Using a Conductive Atomic Force Microscope Tip, D. Abusch-Magder, D. Monroe, R. N. Kleinman, and M. A. Alam (Bell Labs – Lucent Technologies)

3:18 PM P3.7 Degradation of Ultra-thin SiO2 Under Combined Substrate Hot Electron and Tunneling Stress, E. M. Vogel1, J. S. Suehle1, M. D. Edelstein1, B. Wang2, Y. Chen2, and J. B. Bernstein2 (1National Institute of Standards and Technology, 2University of Maryland)

3:21 PM BREAK
Session 4 – Silicon Carbide
Thursday, December 2, 1999
Session Chair: K. Vanheusden (Air Force Research Laboratory)

4:00 PM 4.1 Observations of Different Passivation Behavior for Defects in 3C-SiC and 6H-SiC, P. J. Macfarlane and M. E. Zvanut (University of Alabama at Birmingham)

4:20 PM 4.2 Interface Trapping Studied by Light Emission from SiC MOSFETs, R. E. Stahlbush and G. G. Jernigan (Naval Research Laboratory)

4:40 PM 4.3 On the Cause of Low Transconductance in 4H- and 6H-SiC MOSFETs, N. S. Saks1, A. K. Agarwal23, S. S. Mani24, and V. S. Hegde2 (Naval Research Laboratory, 3Northrop Grumman Corp, 4now at CREE Research Inc., 5now at Sandia National Laboratory)

5:00 PM Discussion

Posters P4.1-P4.8
Thursday, December 2, 1999
Session Chair: N. Saks (Naval Research Laboratory)

5:10 PM P4.1 Theory of the Three-fold Coordinated Si Centers in Si-SiO2 Systems, S. P. Karna1, H. A. Kurtz2, R. D. Pugh1, and W. M. Shedd1 (Air Force Research Laboratory, Kirtland AFB, 2University of Memphis)

5:13 PM P4.2 Interface States Due to Silicon Dangling Bonds in Si(100)/ SiO2 and the Passivation and Depassivation by Atomic Hydrogen, C. Kaneta, T. Yamasaki, T. Uchiyama1, T. Uda1, and K. Terakura2 (Fujitsu Laboratories Ltd., Japan, JRCAT-1ATP, 2NAIR, Tsukuba, Japan)

5:16 PM P4.3 Mechanism and Energy of Oxygen Vacancy Formation in a-SiO2, A. C. Pineda1, S. P. Karna2, R. A. B. Devine2, W. M. Shedd2, and R. D. Pugh2 (1University of New Mexico, 2US Air Force Research Laboratory, KAFB, 3France Télécom-CNET)

5:19 PM P4.4 Ultra-Thin Oxide on Silicon: Roles of Charged and Neutral Oxidising Species from Ab-Initio and Monte Carlo Calculations, M. A. Szymanski, A. M. Stoneham, and A. Shluger (University College London)

5:22 PM P4.5 Nanoscale Analysis on Interface States Distribution at SiO2/Si(111) With an Atomic Force Microscope, R. Hasunuma, A. Ando1, K. Miki1, and Y. Nishioka (Texas Instruments Tsukuba R & D Center, Japan, 1Electrotechnical Laboratory, Tsukuba, Japan)

5:25 PM P4.6 Dissociation Kinetics of Hydrogen-Passivated P2 defects at the (111)Si/SiO2 Interface, A. Stesmans (University of Leuven)

5:28 PM P4.7 Conversion of Oxide Charge into Interface Traps as Measured by a Novel Charge Pumping Technique, A. Melik-Martirosian and T. P. Ma (Yale University)
5:31 PM  P4.8 Hot-Carrier Induced Interface Trap Distributions in Conventional and Asymmetric Channel MOSFETs as Determined by a Novel Charge Pumping Technique, S. Mahapatra, V. Ramgopal Rao, C. D. Parikh, J. Vasi, B. Cheng1, and J. C. S. Woo2 (Indian Institute of Technology, Bombay, India, 1Motorola, Austin, TX, 2University of California, Los Angeles, CA)

7-10 PM  Poster Reception

Session 5 – Breakdown I
Friday, December 3, 1999
Session Chair: J. Suiñe (Universitat Autònoma de Barcelona)

8:00 AM  5.1 Invited Oxide Damage and Breakdown: the Crucial Role of Anode Injected Holes, J. C. Bude, B. E. Weir, P. J. Silverman, and M. A. Alam (Bell Laboratories – Lucent Technologies)

8:30 AM  5.2 Invited Defect Generation and Reliability of Ultra-Thin SiO2 at Low Voltage, J. H. Stathis and D. J. DiMaria (IBM T. J. Watson Research Center)

9:00 AM  5.3 Invited Relationship Between Defect Site Generation and Dielectric Breakdown Studied by “A-Mode” Stress Induced Leakage Current, Kenji Okada (Matsushita Electronics)

9:30 AM  Panel Discussion and Questions on Papers 5.1 – 5.3

10:10 AM  BREAK

Session 6 – Breakdown II
Friday, December 3, 1999
Session Chair: Y. Nishioka (Texas Instruments)

10:50 AM  6.1 Are Soft-breakdown and Hard-breakdown of Thin Gate Oxides Different Failure Mechanisms?, J. Suñé, G. Mura1, and E. Miranda2 (Univ. Autònoma de Barcelona, 1on leave from Univ. di Cagliari, 2now at Univ. de Buenos Aires)

11:10 AM  6.2 Breakdown During High-Field Bias-Temperature Stress, D. M. Fleetwood1, L. C. Riewe, and F. W. Sexton (Sandia National Labs, 1now at Vanderbilt University)

11:30 AM  6.3 Electron Energy Dependence of MOS Degradation, D. J. DiMaria (IBM T. J. Watson Research Center)


12:10 noon  Discussion

Informal “Rump Sessions” (Optional, to be scheduled)
Friday, December 3, 1999 afternoon
Session 7 – Theory  
Saturday, December 4, 1999  
Session Chair: R. Wallace (University of North Texas)

8:00 AM  7.1 Invited Hydrogen Electrochemistry in Silica and Implications for MOSFETs, Peter E. Bloechl (IBM Zurich Research Laboratories)

8:40 AM  7.2 Proton Mobility in a-SiO₂, H. A. Kurtz¹ and S. P. Karna² (¹University of Memphis, ²Air Force Research Laboratory, Kirtland AFB)

9:00 AM  7.3 Effect of Near-Interface Network Strain on the Mobility of Protons in Buried Oxide, P. P. Korambath¹, K. Vanheusden¹, H. A. Kurtz², S. P. Karna¹, W. M. Shedd¹, and R. D. Pugh¹ (¹Air Force Research Laboratory, Kirtland AFB, ²University of Memphis)


9:40  Discussion

9:50  BREAK

Session 8 – Oxidation and Defects  
Saturday, December 4, 1999  
Session Chair: B.-Y. Nguyen (Motorola)

10:30 AM  8.1 Invited Interface Formation in the Growth of Oxides and Nitrides, Y. J. Chabal, K. T. Queeney, M. K. Weldon and K. Raghavachari (Bell Laboratories – Lucent Technologies)

11:10 AM  8.2 Real Time Observation of Initial Stage of Oxidation on Si(001) Surface, K. Miki, Y. Kudo¹, M. Murata¹, and K. Yamabe¹ (Electrotechnical Laboratory, Tsukuba, Ibaraki, Japan, ¹Tsukuba University, Tenodai, Tsukuba, Japan)

11:30 AM  8.3 Do P₃¹ Centers Have Levels in the Si Band Gap? A Spin Dependent Recombination Study of the P₃¹ ²⁹Si “Hyperfine Spectrum”, T. D. Mishima and P. M. Lenahan (Penn State University)

11:50 AM  8.4 On the Hole Trap in the Gate Silicon Dioxide, H. K. Sii, J. F. Zhang, G. Groeseneken¹, and R. Degraeve¹ (Liverpool John Moores University, ¹IMEC)

12:10 PM  Discussion

12:20 PM  Closing Remarks