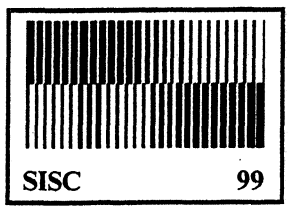


30th IEEE Semiconductor Interface Specialists Conference

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

ABSTRACTS

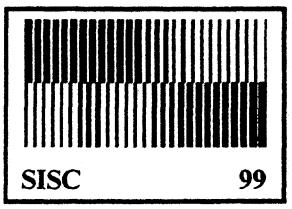
General Chair: Dan Fleetwood

Technical Chair: Beall Fowler

Arrangements Chair: Kathy Krisch

Past Conference Chair: Len Trombetta

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 To encourage future participants to submit new, unpublished work, the conference policy is that *the abstracts may not be referenced.*



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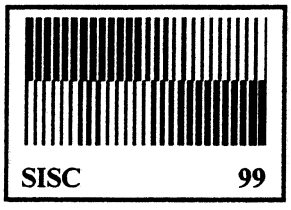

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SISC Ed Nicollian Award for Best Student Paper

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
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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	

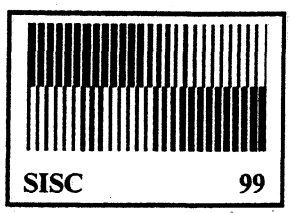
Champagne Reception	**7 PM – 7:30 PM**	**Queen St. Gallery**
Conference Banquet* and Limerick Contest	**7:30 PM – 10 PM**	**Signers Ballroom**
Meeting (1999/2000 Program Committees only)	*10 PM – 11 PM*	*Middleton Room*
Hospitality Suite	10 PM - 12 AM	Presidential Suite

*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!



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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_2O_5) as a Dielectric Film for Silicon-Based Devices** C. Chaneliere 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_2O_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[1], T. P. Ma[1], and T. Tamagawa[2] ([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 Dijk[3], C. Werkhoven[2], P. W. Mertens[1], M. M. Heyns[1], and A. Stesmans[4] ([1]IMEC, [2]ASM America, [3]ASM Europe, [4]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[1,2], A. Paccagnella[1,2], A. Cester[1,2], L. Larcher[3], and G. Ghidini[4] ([1]Univ. di Padova, [2]Unità INFM, [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 Suñé and Xavier Oriols (Universitat Autònoma de Barcelona)

2:30 PM 3.3 **Modeling and Simulation of the Effect of Direct Tunneling in the Gate Dielectric on the Drain-Current Characteristics of Deep-Submicron MOSFETS,** J. P. Shiely, M. Shen, A. Shanware, and H. Z. Massoud (Duke University)

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)

3:03 PM P3.2 **Mechanisms of Thermal Oxidation of 6H Silicon Carbide,** J.-J. Ganem[1], I. C. Vickridge[1], I. Trimaille[1], G. Battistig[2], and E. Szilagyi[2] ([1]University of Paris, [2]MTA – Research Inst. for Technical Physics and Mat. Sci., Budapest)

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)

3:09 PM P3.4 **I – V Characteristics of Ultra Thin Oxide Films after Soft Breakdown,** S. Uno, T. Sakura, Y. Kamakura, and K. Taniguchi (Osaka University)

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

3:15 PM P3.6 **Electrical Imaging of SiO_2 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 SiO_2 Under Combined Substrate Hot Electron and Tunneling Stress,** E. M. Vogel[1], J. S. Suehle[1], M. D. Edelstein[1], B. Wang[2], Y. Chen[2], and J. B. Bernstein[2] ([1]National Institute of Standards and Technology, [2] University 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. Saks[1], A. K. Agarwal[2,3], S. S. Mani[2,4], and V. S. Hegde[2] ([1]Naval Research Laboratory, [2]Northrop Grumman Corp, [3]now at CREE Research Inc., [4]now 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-SiO_2 Systems,** S. P. Karna[1], H. A. Kurtz[2], R. D. Pugh[1], and W. M. Shedd[1] ([1]Air Force Research Laboratory, Kirtland AFB, [2]University of Memphis)

5:13 PM — P4.2 **Interface States Due to Silicon Dangling Bonds in Si(100)/ SiO_2 and the Passivation and Depassivation by Atomic Hydrogen,** C. Kaneta, T. Yamasaki, T. Uchiyama[1], T. Uda[1], and K. Terakura[2] (Fujitsu Laboratories Ltd., Japan, JRCAT-([1]ATP, [2]NAIR), Tsukuba, Japan)

5:16 PM — P4.3 **Mechanism and Energy of Oxygen Vacancy Formation in *a*-SiO_2,** A. C. Pineda[1], S. P. Karna[2], R. A. B. Devine[3], W. M. Shedd[2], and R. D. Pugh[2] ([1]University of New Mexico, [2]US Air Force Research Laboratory, KAFB, [3]France 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 SiO_2/Si(111) With an Atomic Force Microscope,** R. Hasunuma, A. Ando[1], K, Miki[1], and Y. Nishioka (Texas Instruments Tsukuba R & D Center, Japan, [1]Electrotechnical Laboratory, Tsukuba, Japan)

5:25 PM — P4.6 **Dissociation Kinetics of Hydrogen-Passivated P_b Defects at the (111)Si/SiO_2 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. Cheng[1], and J. C. S. Woo[2] (Indian Institute of Technology, Bombay, India, [1]Motorola, Austin, TX, [2]University of California, Los Angeles, CA)

7-10 PM **Poster Reception**

Session 5 – Breakdown I

Friday, December 3, 1999

Session Chair: J. Suñé (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 SiO_2 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. Mura[1], and E. Miranda[2] (Univ. Autònoma de Barcelona, [1]on leave from Univ. di Cagliari, [2]now at Univ. de Buenos Aires)

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

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

11:50 AM 6.4 **Investigation of Properties of SiO_2 Defects Created During Electric Stressing at Different Temperatures,** B. Kaczer, R. Degraeve, N. Pangon, and G. Groeseneken (IMEC)

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-SiO_2,** H. A. Kurtz[1] and S. P. Karna[2] ([1]University of Memphis, [2]Air 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. Korambath[1], K. Vanheusden[1], H. A. Kurtz[2], S. P. Karna[1], W. M. Shedd[1], and R. D. Pugh[1] ([1]Air Force Research Laboratory, Kirtland AFB, [2]University of Memphis)

9:20 AM — 7.4 **Stability of H^0 in SiO_2: A First Principles Investigation of Competition Between Dimerization and Disproportionation,** A. H. Edwards, W. M. Shedd, and R. D. Pugh (Air Force Research Laboratory, KAFB)

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. Kudo[1], M. Murata[1], and K. Yamabe[1] (Electrotechnical Laboratory, Tsukuba, Ibaraki, Japan, [1]Tsukuba University, Tenodai, Tsukuba, Japan)

11:30 AM — 8.3 **Do P_{b1} Centers Have Levels in the Si Band Gap? A Spin Dependent Recombination Study of the P_{b1} ^{29}Si "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. Groeseneken[1], and R. Degraeve[1] (Liverpool John Moores University, [1]IMEC)

12:10 PM — **Discussion**

12:20 PM — **Closing Remarks**