

T. S. SUDARSHAN

Carolina Distinguished Professor and Fellow of IEEE
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EDUCATIONAL RECORD

1. Ph.D. Electrical Engineering (High Voltage Electrical Engineering)
October 1974 University of Waterloo, Ontario, Canada
Thesis title: *Flashover of Solid Insulators in Vacuum*
2. M.A.Sc. Electrical Engineering (High Voltage Engineering)
August 1972 University of Waterloo, Ontario, Canada
Thesis title: *Field Enhancement due to Solid Insulators Subjected to High DC Stresses in Vacuum*
3. M.Sc. Physics (Solid state)
June, 1970 University of Mysore, Mysore, India
4. B.Sc. Physics, Mathematics, and Chemistry
May 1968 University of Bangalore, Bangalore, India

SPECIALIZATIONS AND RESEARCH INTERESTS

Novel techniques of growth of silicon carbide (SiC) bulk and epitaxial films; surface modification to produce porous SiC; SiC material and device processing – wafering, surface polishing, oxidation, mask technology, dopant diffusion, implant activation, and metallization; fabrication and characterization of SiC high power Diodes and Transistors; novel defect characterization methods for wide bandgap semiconductors. High field effects in SiC-based electronic materials and devices; high power solid-state switches; electron emission from thin films, as cold cathodes, for applications in field emission displays; microspacer insulation for flat panel displays; solid, liquid and gas insulated systems for high voltage power apparatus, underground power cable, overhead transmission systems and pulsed power systems; surface flashover of solid dielectrics and photoconducting materials in high vacuum and compressed gas systems; fast high voltage and current diagnostics, and low light level imaging; electric field studies using numerical techniques; insulator degradation and aging, coronas and arcs, power system protection.

EXPERIENCE

September 2006 to present: *Department Chair, Department of Electrical Engineering*
University of South Carolina

1987 to present: *Professor, Department of Electrical Engineering, University of South Carolina*
Research activity in the areas of (1) SiC bulk growth, wafering, and surface preparation; defect characterization; CVD film growth; defect characterization; porous SiC; SiC material and device processing; device fabrication and characterization, (2) Surface flashover mechanisms along insulators and photoconducting materials in high vacuum for nanosecond excitations, (3) Insulator surface flashover mechanisms in vacuum and compressed gases for DC, 60 Hz and slow pulsed excitations, (4) High field insulation relevant to vacuum microelectronics, (5) Design of high current, high voltage crowbar switch for fusion applications, (6) Study of the characteristics of high vacuum and compressed gas gaps used as high voltage, high current switching elements, (7) Coating of metal surfaces with liquid metals for applications in high power switches, (8) Application of plasmas to metal surface coatings and alloying, and (9) Characterization of the degradation of Barium Titanate insulated capacitors.

1982 - 1987: *Associate Professor, Department of Electrical and Computer Engineering*
University of South Carolina

1979 – 1982: *Assistant Professor, Department of Electrical and Computer Engineering*
University of South Carolina.

1974 - 1979: *Research Officer in the Electrical Engineering Division*
National Research Council of Canada, Ottawa

Responsible for (1) the study of the deterioration of polymeric materials used in underground power cables, (2) developing additives to retard the degradation of polyethylene, to improve the overall reliability of the power system, (3) developing techniques to test insulating materials for resistance to discharges, (4) studying accelerated aging of insulating materials, and (5) studying the characteristics of insulating materials at cryogenic temperatures.

1971 - 1974: *Research Assistant, University of Waterloo, Ontario, Canada*

Research work included study of mechanisms involved in the flashover of insulators in vacuum subject to high stresses. Measurement of electric fields were made in the proximity of insulators due to positive charging caused by HV stress. Suitable insulator coatings, which reduced the charging, were developed, improving breakdown performance by nearly 300%. The study also involved high-speed photography of electric arcs along insulator surfaces using an image converter camera, electron microprobe analysis of microparticles, and computer simulation of prebreakdown phenomena.

HONORS AND AWARDS

- Russell Research Award awarded by USC for innovative research 2010
- USC International Advocate award for student outreach to international students 2010
- Carolina Trustee Professorship awarded by USC Board of Trustees 2009
- Governor's Distinguished Professor award by the Commission on Higher Education 2007
- Carolina Distinguished Professor reappointment in May 2007 for five years 2007
(continuous appointment from 1987 to 2012)
- Irons Endowed Distinguished Lecturer, Rutgers University, the State University 2007
Of New Jersey 2007
- Michael J. Mungo Distinguished Professor of the Year award 2006
- Governor's Distinguished Professor Award 2006
- Fellow of the Institute of Electrical & Electronic Engineers (IEEE) 2005
- College of Engineering and Information Technology Research Achievement Award 2001
- Carolina Distinguished Professor 1995 to present
- Carolina Research Professor 1986 to 1994
- Alpha chapter of Mortar Board Excellence in Teaching Award Nov. 1991
- College of Engineering Research Achievement Award 1991
- Carolina Education Foundation Award for Research in Science and Engineering 1990
- Sigma Chi Outstanding Teacher of the Year 1985
- Outstanding Young Men of America 1982
- Who is Who in Technology 1980
- Council of Scientific and Industrial Research Fellowship 1970-1971
- India National Merit Scholarship 1968-1970

PROFESSIONAL AND HONOR ORGANIZATION MEMBERSHIPS, ACTIVITIES

- Fellow, Institute of Electrical and Electronics Engineering, Inc. (IEEE)
- Eta Kappa Nu, national Electrical and Computer Engineering Honor Society
- Tau Beta Pi, Engineering Honor Society
- Sigma Xi, Scientific Research Society
- Reviewer of proposals to NSF and member of NSF panel review of SBIR proposals.
- Materials Research Society (MRS)
- Electrical and Computer Engineering Department Heads Association (ECEDHA)
- Southeast Electrical and Computer Engineering Department Heads Association (SECEDHA)

- American Society for Engineering Education (ASEE)

KEY RESEARCH ACCOMPLISHMENTS

- 1976 Development of Cr₂O₃ coatings to inhibit failure of insulators at high voltages. This coating is extensively used in electron accelerators, X-ray tubes, e-beam lithography equipment, and in faint object spectrograph in the Hubble space telescope. *IEEE Trans. on Electrical Insulation*
- 1984 Wetting of metal surfaces with a liquid metal. Widely used in high current switches. *J. Appl. Phys*
- 1987 Novel insulator designs. Widely used in high energy particle accelerators. *IEEE Trans. on Electrical Insulation*
- 1989 Novel design of high voltage feedthrough. Used in INTELSAT traveling wave tubes. *IEEE Trans. on Electrical Insulation*
- 1993 First ultra high voltage Si photoconducting Switch. *IEEE Trans. on Electrical Insulation*
- 1999 Development of High Field micro-spacer for Flat Panel Emitter Displays. *SPIE Electronic Imaging*
- 2000 First to perform selective doping of SiC by boron diffusion. *Mat. Sci. Forum*
- 2001 Produced defect-free SiC by local epitaxy. *J. Crystal Growth*
- 2002 Developed vacuum gap design rules for vacuum microelectronic applications. *IEEE-DEI*
- 2002 Developed a non-destructive wafer-scale method of delineating defects in SiC. *APL* (Patent issued)
- 2003 Demonstrated formation of nano-porous structures in SiC wafers. *Electrochemical and Solid State Letters*
- 2003 Demonstrated non-degradable SiC pin diodes; patent awarded June 2006.
- 2005 Developed basal plane dislocation-free epitaxial growth of SiC, *APL*
- 2006 Development of new method of forming a graded junction termination extension (JTE) for high voltage SiC devices (up to 10 kV) using high temperature diffusion of boron; Novel Method of Forming Junction Termination Extension for SiC Power Devices, USCRF 000619, Patent submitted with Cree, Inc. 2009
- 2007 Demonstrated extremely high carrier lifetime (~10 us) in thin epilayers (~20-30 um); A method to increase and control carrier lifetime in SiC, USCRF 694
- 2008 Demonstrated step-bunch free epilayers in 4 degree off-cut substrates; optimized the epilayer growth for reduction of triangular defects from 850 cm⁻² to 5 cm⁻²; Optimized the epilayer growth for reduction of triangular defects from 850 cm⁻² to 5 cm⁻²
- 2008 Demonstrated high growth rate (>50 um/hr) using Dichlorosilane in 8 degree off substrates, *J. of Crystal Growth*, submitted
- 2009 Developed a method to grow semi-insulating SiC films with significant applications in SiC power devices including photo-conducting switches, *J. of Crystal Growth*, under preparation

PATENTS

1. U.S. Patent No. 4,780,176, A Method of Wetting a Metal with Liquid Metals by a Plasma Interaction Technique, October 25, 1988.
2. U.S. Patent No. 7,061,021 B2, June 13, 2006. System and Method for Fabricating Diodes, T.S. Sudarshan, S. Soloviev, and Y. Gao.
3. U.S. Patent No. 7,220,978, May 22, 2007, System and method for detecting defects in semiconductor wafers, T. S. Sudarshan and Xianyun Ma.
4. U.S. Patent Application, "Methods, Wires, and Apparatus for Slicing Hard Materials", Attorney Docket No. USC-134, September 17, 2008.
5. U. S. Patent Application, "Novel JTE Formation Technique for Use in Silicon Carbide Power Devices, T. S. Sudarshan, A. Bolotnikov, Q. Zhang, and A. Agarwal. Submitted for filing by Cree, Inc., December 2009.
6. U. S. Patent Application 12/73369, "METHODS OF GROWING A SILICON CARBIDE EPITAXIAL LAYER ON A SUBSTRATE TO INCREASE AND CONTROL CARRIER LIFETIME," Tangali S. Sudarshan and Amitesh Srivastava, USC Ref. 784; Dorrity & Manning ref. 224, October 2010.

DISCLOSURES TO USC INTELLECTUAL PROPERTY OFFICE

1. "A Novel Method of Rapid Epitaxial Growth of Silicon Carbide (SiC) that Heals Micropipes in Commercial SiC Substrates," T.S. Sudarshan, Y. Khlebnikov, and I. Khlebnikov, disclosure #98171, Jan. 14, 1998.

2. "Local Epitaxy, Diffusion, and Etching Related to Silicon Carbide and Other Wide Bandgap Semiconductors," T.S. Sudarshan, Y. Khlebnikov, and I. Khlebnikov, disclosure #98174, May 1, 1998.
3. "Bulk Silicon Carbide Crystal Growth by a Modified Vapor Transport Technique," T.S. Sudarshan, Y. Khlebnikov, and I. Khlebnikov, disclosure #98175, May 1, 1998.
4. "An Electrochemical Polishing Technique for the Surface Preparation of SiC," T.S. Sudarshan, Y. Khlebnikov, and I. Khlebnikov, disclosure #99207, Dec. 1998.
5. "High Power Large Area Schottky Diode," Q. Zhang, T.S. Sudarshan, and V. Madangarli, disclosure #99204, April 26, 1999.
6. "Thick Oxide Film Deposition on Silicon Carbide," T.S. Sudarshan, Q. Zhang, and I. Khlebnikov, disclosure #99205, April 26, 1999.
7. "Rapid Anodic Oxidation of Silicon Carbide," T.S. Sudarshan, Y. Khlebnikov, and I. Khlebnikov, disclosure #99206, April 26, 1999.
8. "A Novel Base Design for High Power Transistors, Thyristors, and Other Devices," Q. Zhang and T.S. Sudarshan, disclosure #99230, Jan. 2000.
9. "Silicon Carbide Wafer Design for High Power Device Fabrication," Q. Zhang and T.S. Sudarshan, disclosure #99208, May, 1999.
10. "A Technique to Eliminate Premature Breakdown at the Edge of Thin Film Electrodes," X. Ma and T.S. Sudarshan, disclosure #20239, Jan. 2000.
11. "A Technique for Alleviating Spacer Triple Junction-Initiated Breakdown," X. Ma and T.S. Sudarshan, disclosure #20250, May 2000.
12. "A Novel Schottky Diode Structure with Low On-State Resistance," Q. Zhang and T.S. Sudarshan, June 27, 2001.
13. "A Novel JFET Structure for High Power, High Frequency Applications," Q. Zhang and T.S. Sudarshan, June 27, 2001.
14. "Novel Schottky Diode Structure for High Power Applications," Q. Zhang and T.S. Sudarshan, Oct. 2001.
15. "Nondestructive Defect Delineation in SiC Wafers Using the Optical Stress Technique," X. Ma and T.S. Sudarshan, #00367, April 2002.
16. "Development of Interfaces to Facilitate the Implantation of Biosensor Based Deveices," N. Sethuraman and T.S. Sudarshan, Dec. 2002.
17. "A Method of Eliminating Forward Voltage Drift in SiC PiN and PN Diodes," S. Soloviev, Y. Gao, and T.S. Sudarshan, March 2003.
18. "New Biomaterial for Bone Implant Applications," N. Sethuraman, T.S. Sudarshan, and J. Morris, Sep. 2003.
19. "Abrasive Wire Used for Slicing Semiconductor Boules", T.S.Sudarshan, I.Agafanov, Y.Khlebnikov and M.Parker USCRF 446, June 2004.
20. "Method and Apparatus for Slicing Hard Brittle Materials", T.S.Sudarshan and I.Agafanov, USCRF Ref 465, Provisional Patent – 2/11/2005.
21. "Epitaxial Growth of Basal Plane Dislocations-Free Silicon Carbide Films", T.S.Sudarshan and Z.Zhang, USCRF Ref 464, Provisional Patent – 11/17/04.
22. "Growth of Low Basal Plane Dislocation Epilayers of SiC with Minimized Surface Depressions", T.S.Sudarshan, Z.Zhang, USCRF Ref 540, Nov 2005.
23. "Mask Design for Low Defect Density Lateral Epitaxially Overgrown SiC Films", T.S.Sudarshan, A.Bolotnikov and S.Soloviev(GE), Jan 2006.
24. "Novel Method of Forming Junction Termination Extension for SiC Power Devices," T. S. Sudarshan and A. Bolotnikov, USCRF #000619, 10/20/2006.

25. "A method to increase and control carrier lifetime in SiC Epilayers," T. S. Sudarshan and Amitesh Shrivastava, disclosed and submitted to Intellectual Property Office, USC #694, disclosed and submitted to Intellectual Property Office, October 3, 2007.
26. "Silicon Carbide and Related Wide Bandgap Semiconductor Based Optically-Controlled Power Switching Devices," Feng Zhao and Tangali S. Sudarshan, disclosed and submitted to USC Intellectual Property Office, January 20, 2009. SCRF# 00784, non-provisional patent application filed for this on 5/4/2010, Application Serial No. 12/773,369. Notice of publication on 11/18/2010.
27. "Methods of Growing a Silicon Carbide Epitaxial Layer on a Substrate to Increase and Control Carrier Lifetime," non-provisional patent application filed for USCRF #000694, Application Serial No. 12/876,729. Notice of publication on 3/28/2010.

BOOK CHAPTERS

1. T.S. Sudarshan, "Vacuum Insulation," *Wiley Encyclopedia of Electrical and Electronic Engineering*, **invited chapter**, 1999.
2. Khlebnikov, D. Cherednichenko, Y. Khlebnikov, and T.S. Sudarshan, "Silicon Carbide Technology: Status and Future," *International School on Crystal Growth of Technologically Important Electronic Materials (ISCGTIEM)*, Mysore, India January 2003.
3. T.S. Sudarshan, "Materials Science and Engineering of Bulk Silicon Carbides" in: *SiC Power Materials*, ed. Dr. Z.C. Feng, Springer-Verlag **invited chapter**, pp. 1-61, 2004.
4. T.S. Sudarshan, D. Cherednichenko, and R. Yakimova, "Growth of Silicon Carbide," in: *Bulk Crystal Growth of Electronic, Optical and Optoelectronic Materials*, ed. Dr. P. Capper, Wiley and Sons, **invited chapter**, pp. 433-449, 2004.
5. S. I. Soloviev and T. S. Sudarshan, "Processing Porous SiC: Diffusion, Oxidation, Contact Formation," *Porous Silicon Carbide and Gallium Nitride: Epitaxy, Catalysts, and Biotechnology Applications*, edited by R. M. Feenstra and C.E.C. Wood, John Wiley & Sons, Ltd., 2008.

RESEARCH PUBLICATIONS

A.1. ARCHIVAL REVIEWED PUBLICATIONS – Recent Publications 2004-2011

194. "Slow de-trapping of minority holes in n-type 4H-SiC epilayers, by P. B. Klein, A. Shrivastava, and T. S. Sudarshan, *Physica Status Solidi A*, 1-6, July 2011 / DOI 10.1002/pssa .201127260.
193. "Investigations of defect evolution and basal plane dislocation elimination in CVD epitaxial growth of silicon carbide on eutectic etched epilayers," Haizheng Song, Tawhid Rana, and Tangali S. Sudarshan, *Journal of Crystal Growth*, v. 320, Issue 1, p. 95-102, April 2011.
192. "Characterization of 4H semi-insulating silicon carbide single crystals using electron beam induced current," by Peter G. Muzhkov, Ramesh Krishna, Sandip Das, Timothy Hayes, Tangali S. Sudarshan, Krishna C. Mandal, *Materials Letters*, 65, p. 911-914, December 2010.
191. "High growth rate 4H-SiC epitaxial growth using dichlorosilane in a hot-wall CVD reactor," by Iftekhar Chowdhury, M.V.S. Chandrashekar, Paul B. Klein, Joshua D. Caldwell, Tangali Sudarshan, *Journal of Crystal Growth*, December 2010.
190. "Recombination processes controlling the carrier lifetime in n-4H-SiC epilayers with low Z1/2 concentrations," by P. B. Klein, R. Myers-Ward, K.-K. Lew, B. L. VanMil, C. R. Eddy, Jr., D. K. Gaskill, A. Shrivastava, and T. S. Sudarshan, *Journal of Applied Physics*, 108, 0333713, August 12, 2010.

189. "Effect of threading screw and edge dislocations on transport properties of 4H-SiC homoepitaxial layers," by S. I. Maximenko, J. A. Freitas, Jr., R. L. Myers-Ward, K. K. Lew, B. L. VanMil, C. R. Eddy, Jr., D. K. Gaskill, P. G. Muzykov, and T. S. Sudarshan, *Journal of Applied Physics*, 108, 013708, July 8, 2010.
188. "Effect of crystallographic dislocations on the reverse performance of 4H-SiC p-n diodes," by Feng Zhao, Mohammad M. Islam, Biplob K. Daas, Tangali S. Sudarshan, *Materials Letters*, Vol. 64, pp. 281-283. October 2009.
187. "Optically Activated 4H-SiC p-i-n Diodes for High-Power Applications," by Feng Zhao, Mohammad M. Islam, Peter Muzykov, Alex Bolotnikov, and Tangali S. Sudarshan, *IEEE Electron Device Letters*, Vol. 30, No. 11, 1182 – 1184, November 2009.
186. "Bulk SiC Crystal Growth at Constant Growth Rate Utilizing a New Design of Resistive Furnace," by Eugene Tupitsyn, Alexander Galyukov, Maxim Bogdanov, Alexey Kulik, Mark Ramm, Yuri Makarov, Tangali Sudarshan, *Materials Science Forum*, Vols. 600-603, pp. 27-30, 2009.
185. "Cathodoluminescence Study of the Properties of Stacking Faults in 4H-SiC Homoepitaxial Layers," by Serguei I. Maximenko, Jaime A. Freitas, Jr., Paul B. Klein, Amitesh Shrivastava, and Tangali S. Sudarshan, *Applied Physics Letters*, 94, 092101, March 2009.
184. "Two-Branch Boron Diffusion from Gas Phase in n-Type 4H-SiC," by A. V. Bolotnikov, P. G. Muzykov, Anant Agarwal, Qing Chun Zhang, and Tangali S. Sudarshan, *Silicon Carbide and Related Materials 2008*, *Materials Science Forum*, Vols. 614-617, pp. 453-456, March 2009.
183. "Study of Leakage Current and Breakdown Issues in 4H-SiC Unterminated Schottky Diodes," by P. G. Muzykov, A. V. Bolotnikov, and T. S. Sudarshan, *Solid State Electronics*, Vol. 53, Issue 1, pp. 14-17, January 2009.
182. "Investigation of Triangular Defects on 4H-SiC 4° off cut (0001) Si Face Epilayers Grown by CVD", by A. Shrivastava, P. Muzykov, B. Pearmen, S. Michael Angel, and T. S. Sudarshan, *Materials Science Forum*, Vols. 600-603, pp. 139-142, 2009.
181. "Variations in the measured carrier lifetimes of N⁻ 4H-SiC epilayers," by P. B. Klein, J. D. Caldwell, Amitesh Shrivastava, and T. S. Sudarshan, *Materials Science Forum*, Vols. 600-603, pp. 489-492, 2009.
180. "Identification of nucleation sites and formation mechanism of inverted pyramids in 4H-SiC epilayers", by A. Shrivastava, P. Muzykov, and T. S. Sudarshan, *Journal of Applied Physics*, 104, 003532, November 2008.
179. "Physical Phenomena Affecting Performance and Reliability of 4H-SiC Bipolar Junction Transistors," by Peter G. Muzykov, Robert M. Kennedy, Qingchun (Jon) Zhang, Craig Capell, Al Burk, Anant Agarwal, Tangali S. Sudarshan, *Microelectronics Reliability*, Vol. 49, Issue 1, pp. 32-37, January 2009.
178. "Study of Triangular Defects and Inverted pyramids in 4H-SiC 4° off cut (0001) Si face epilayers," by A. Shrivastava, P. Muzykov, J. D. Caldwell, and T. S. Sudarshan, *Journal of Crystal Growth*, Vol. 310, Issue 20, pp. 4443-4450, October 2008.
177. "Effect of crystallographic defects on the performance of 4H-SiC JBS Diodes", "A. Grekov, Qingchun Zhang, Husna Fatima, Anant Agarwal and T. Sudarshan, *Microelectronics Reliability*, Vol. 48, Issue 10, pp. 1664-1668, October 2008.
176. "Structural and Chemical Comparison of Graphite and BN/AlN Caps Used for Annealing Ion Implanted SiC," by K.A. Jones, M.C. Wood, T.S. Zheleva, K.W. Kirchner, M.A. Derenge, A. Bolotnikov, T.S. Sudarshan, R.D. Vispute, S.S. Hullavarad, and S. Dhar, *Journal of Electronic Materials*, Vol 37, No. 6, June 2008. Also published online at SpringerLink, March 11, 2008, <http://www.springerlink.com/content/125244w14jw71721>

175. "Investigation of two-branch boron diffusion from vapor phase in n-type 4H-SiC," by A. V. Bolotnikov, P. G. Muzykov, and T.S. Sudarshan, *Applied Physics Letters*, 93, 052101, August 2008.
174. "Characteristics of Dislocation Half-Loop Arrays in 4H-SiC Homo-Epilayer," by Z. Zhang, R. E. Stahlbush, P. Pirouz, and T. S. Sudarshan, *Journal of Electronic Materials*, Vol. 36, No. 5, May, 2007.
173. "Polytype Stability and Microstructural Characterization of Silicon Carbide Epitaxial Films Grown on [1120]- and [0001]-Oriented Silicon Carbide Substrates," S. M. Bishop, C. L. Reynolds Jr., Z Liliental-Weber, Y. Uprety, J. Zhu, D. Wang, M. Park, J. C. Molstad, D. E. Barnhardt, A Shrivastava, T. S. Sudarshan, and R. F. Davis, *Journal of Electronic Materials*, Vol 36, No. 4, pp. 285-296, March, 2007.
172. "Improvement of 4H-SiC Power p-i-n Diode Switching Performance Through Local Lifetime Control Using Boron Diffusion," Alexander Bolotnikov, Peter Muzykov, Alexander Grekov, and T. S. Sudarshan, *IEEE Transactions on Electron Devices*, Vol. 54, No. 6, pp. 1540-1544, June 2007.
171. "Comparison of Graphite and BN/AlN Annealing Caps for Ion Implanted SiC," K. A. Jones, M. C. Wood, T. S. Zheleva, K. W. Kirchner, M. A. Derenge, A. Bolonikov, T. S. Sudarshan, R. D. Vispute, S. S. Hullavarad, and S. Dhar, *Materials Science Form*, Vol. 556-557, pp. 575-578, September 2007.
170. "Inhomogeneities in Ni/4H-SiC Schottky barriers: Localized Fermi-level pinning by defect states," D. J. Ewing, L. M. Porter, Q. Wahab, X. Ma, T. S. Sudarshan, S. Tumakha, M. Gao, and L. J. Brillson, *Journal of Applied Physics*, **101**, 114514, June, 2007.
169. "Free carrier distribution profiling of 4H-SiC substrates using a commercial optical scanner," Joshua D. Caldwell, Orest J. Glembocki, Sharka M. Prokes, Evan R. Glaser, Karl D. Hobart, Darren M. Hansen, Gilyong Chung, Alexander V. Bolotnikov, and Tangali S. Sudarshan, *Journal of Applied Physics*, **101**, 093506, May, 2007.
168. "Controllable 6H-SiC to 4H-SiC polytype transformation during PVT growth," E. Y. Tupitsyn, A. Arulchakkaravarthi, R. V. Drachev, and T. S. Sudarshan, *Journal of Crystal Growth*, Vol. 299, Issue 1, pp. 70-76, January, 2007.
167. "Analysis of Nonexponential Deep-Level Current Transients in Schottky Diodes Fabricated in [1100] 6H-SiC," A. Bolotnikov, P. Muzykov, and T. S. Sudarshan, *J. Elec. Mats.*, Vol. 35, No. 5, 1132, 2006.
166. "Mechanism of Eliminating Basal Plane Dislocations in SiC Thin Films by Epitaxy on an Etched Substrate," Z. Zhang, E. Moulton, and T. S. Sudarshan, *Appl. Phys. Lett.* Vol. 89, 081910, August 2006.
165. "Propagation of Stacking Faults from Surface Damage in SiC PiN Diodes", with Z. Zhang, S. I. Maximenko, A. Shrivastava, P. Sadagopan, Y Gao, and T. S. Sudarshan, *Appl. Phys. Lett.*, Vol. 88, 062101, February 2006.
164. "Bulk Growth of Single Crystal Silicon Carbide" *Microelectronic Engineering*, T. S. Sudarshan and S. I. Maximenko, *Microelectronic Engineering*, Vol. 83, No. 1, pp. 155-159, January 2006.
163. "Investigation on Barrier Inhomogeneities in 4H-SiC Schottky Rectifiers," Xianyun Ma, Priyamvada Sadagopan, and Tangali S. Sudarshan, *Phys. Stat. Sol. (a)*, Vol. 203, No. 3, pp. 643-650, February, 2006.
162. "Nanoscale Deep Level Defect Correlation with Schottky Barriers in 4H-SiC/Metal Diodes," S. Tumakha, L. M. Porter, D.J. Ewing, Q. Wahab, X.Y. Ma, L. J. Brillson, and T. S. Sudarshan, *Materials Science Forum*, Vols. 527-529, pp. 907-910, 2006.
161. "Fundamental Limitations of SiC PVT Growth Reactors with Cylindrical Heaters," R. Drachev, E. Deyneka, C. Rhodes, J. Schupp, and T. Sudarshan, **Invited**, *Materials Science Forum*, Vols. 527-529, pp. 15-20, 2006.

160. "Stability of Thick Layers Grown on (1-100) and (11-20) Orientations of 4H-SiC," with M. Syvajarvi, R. Yakimova, G. R. Yazdi, A. Arjunan, E. Toupitsyn, and T. S. Sudarshan, *Materials Science Forum*, Vols. 527-529, pp.227-230, October 2006.
159. "Effect of Crystal Defects on Reverse I-V Characteristics of 4H-SiC APD," S. Soloviev, P. Sandvik, S. Arthur, K. Matocha, S. Maximenko, and T. S. Sudarshan, *Materials Science Forum*, Vols. 527-529, pp. 427-430, October 2006.
158. "Recombination Behavior of Stacking Faults in SiC p-i-n Diodes" S. Maximenko, P. Pirouz, and T. S. Sudarshan, *Materials Science Forum*, Vols. 527-529, pp. 367-370, 2006.
157. "Open Core Dislocations and Surface Energy of SiC" with S. Maximenko and P. Pirouz, *Materials Science Forum*, Vols. 527-529 (2006), pp. 439-442.
156. "A Study of Inhomogeneous Schottky Diodes on n-type 4H-SiC" with D. J. Ewing, L. M. Porter, Q. Wahab, S. Tumakha, L. J Brillson, X. Y. Ma, and T. S. Sudarshan, *Materials Science Forum*, Vols. 527-529, pp. 911-914, 2006.
155. "Growth of Low Basal Plane Dislocation Density SiC Epilayers", Z. Zhang and T. S. Sudarshan, *Materials Science Forum*, Vols. 527-529, pp. 243-246, 2006.
154. "Why Are Only Some Basal Plane Dislocations Converted to Threading Edge Dislocations during SiC Epitaxy?" Z. Zhang, A. Shrivastava, *Materials Science Forum*, Vols. 527-529, pp. 419-422, 2006.
153. "Performance of SiC PiN Diodes Fabricated on Basal Plane Dislocation-free SiC Epilayers", with Z. Zhang, A. Grekov, P. Sadagopan, S. Maximenko, and T. Sudarshan, *Materials Science Forum*, Vols. 527-529, pp. 371-374, 2006.
152. "Investigation on Small Growth Pits in 4H Silicon Carbide Epilayers," X. Ma, H. Chang, Q. Zhang, and T. Sudarshan, *J. Crystal Growth* 279, 425-432, 2005.
151. "A Nondestructive Automated Defect Detection System for Silicon Carbide Wafers" with Toshiro Kubota, Parag Talekar, Xianyun Ma, and Tangali S. Sudarshan, *Machine Vision and Applications*, Vol. 16, pp. 170-176, April 2005.
150. "CVD Growth and Characterization of 4H-SiC Epitaxial Film on (11-20) As-cut Substrates," Ze Hong Zhang, Ying Gao, Arul Arjunan, Eugene Toupitsyn, Priyamvada Sadagopan, and Robert M. Kennedy, and Tangali S. Sudarshan, *Mater. Sci. Forum*, 483-485, 113, 2005.
149. "Defect-driven Inhomogeneities in Ni/4H-SiC Schottky Barriers", with S. Turnakha;, D. J. Ewing and L.M. Porter, Q. Wahab, X. Ma, and L. J. Brillson, *Appl. Phys. Lett.*, 87, 242106, 2005.
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