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OBJECTIVE Pursue R&D in the design, fabrication, and testing of environmental sensors specifically for soil carbon and nitrogen measurements, metals in invertebrates and plants species.

EXPERTISE Design, fabrication, and testing of ion mobility spectrometer on a chip
Laser-induced Plasma and remote Raman spectroscopy, Time-of-flight mass spectrometry
Fabrication of microstrip line, coplanar waveguide, and coplanar strip line photoconductive switches using silicon-on-sapphire, low-temperature GaAs, and -silicon materials
Mask alignment, thickness measurement, lapping and polishing, wire bonding, electroplating
Optoelectronic characterization of three terminal devices (PHEMTs, HBTs, MESFETs)
Cryogenic behavior of semiconductor devices, Photoluminescence of heterostructure layers.

EDUCATION **Ph.D. in Physics**, University of California, Los Angeles, 1992
Thesis Topic: Picosecond Optical Response of Three-Terminal Devices
M.S. in Physics, University of California, Los Angeles, 1987
M.S. in Solid-State Physics, Shivaji University, Kolhapur, India, 1982
Thesis Topic: Transport and Magnetic Properties of Amorphous Semiconductors
B.S. in Physics, University of Nagpur, India, 1980

HONORS **Gold Medal in Physics**, Shivaji University, 1982
University Grants Commission Fellowship, India, 1983 - 1985
Rotary Fellowship, Rotary International Foundation, 1985 - 1986
Graduate Opportunity Fellowship, University of California, Los Angeles, 1989 – 1990
SERDP Project of the Year Award, Co-PI of the project for continuous monitoring of smoke stack emissions by LIPS, 1997 - 2000

PATENT DISCLOSURES

Patent disclosure filed for thin film optical sensor for acids and bases for application to on-line and remote monitoring of industrial processes and waste streams.

Invention Disclosure 0713 was filed for “novel method for preparing and encapsulating radioactive material source forms”.

Patent disclosure 1086 was filed for “An Instrument Combining Two Techniques for Elemental and Molecular Analysis”.

Patent disclosure 1087 was filed for “Method for Using Pulsed Raman Spectroscopy for Soil Analysis (Carbon Sequestration) and Other Applications”.

Patent disclosure 1110 was filed for “LIBS Microprobe for Mapping Elemental Distributions in Cells”.

EXPERIENCE

Oak Ridge National Laboratory, Oak Ridge, Tenn.

1999 - present, Staff Research Scientist

1994 - 1999, Research Associate

LIBS of Soil: Detection of total carbon and nitrogen in soils. Heavy metal and radionuclide detection in soils.

Raman spectroscopy of soil: Characterization of soil organic matter for carbon sequestration.

Microwave heating of soil: Release of dense non-aqueous phase liquid contaminants from soil for in situ detection.

Laser-induced plasma spectroscopy: R&D of portable toxic metal monitor for smoke stack emissions and optimized for Cr, Ni, V, Hg, and Pb aerosols. Extension to solids, cellular, and soil sampling.

Laboratory-on-a-chip: Development and testing of miniature ion mobility spectrometer.

Chemical physics of ions and clusters: Laser-induced clustering of NO using time-of-flight mass spectrometry. Electron attachment to laser-excited molecules (SiH₄, H₂O, CH₄).

University of Tennessee, Knoxville, Measurement and Control Engrg. Center, 1992-1994,
Research Associate

Optical acid sensor: Proposed and developed a non-intrusive optical method for on-line and remote pH measurements of strongly acidic solutions (pH < 1). Patent disclosure filed for thin film optical pH sensor.

Fiber optic Raman spectroscopy: Remote monitoring for process control on industrial-scale organic distillation column.

University of California, Los Angeles, Depts. of Physics, Electrical Engineering, and Chemistry,
1986-1992

Optical and electrical properties of three-terminal devices: Used an optical picosecond network analyzer system to measure the optoelectronic response of HEMTs and HBTs (S-parameters, optical response, cryogenic temperature behavior, photoluminescence), polymer waveguides, and state-of-the-art high-frequency microwave devices fabricated by local industry (TRW, Rockwell, Hughes). Experienced in test fixture fabrication and use of spectrum and parameter analyzers and related instrumentation.

Transport properties of CuCl thin film heterostructures: Modified resistivity measurement equipment for application to high resistivity materials and thin film heterostructures. Designed and built a room-temperature four-probe resistivity measuring apparatus. Analyzed samples using FTIR spectroscopy.

Shivaji University, Physics Department, 1983-1985

Transport and magnetic properties of amorphous semiconductors: Designed and built high-temperature conductivity equipment. Grew amorphous semiconductors and chalcogenide glasses; analyzed their resistivity, magnetic properties, thermoelectric power, and effects of γ -irradiation on transport properties.

PUBLICATIONS

Madhavi Martin, Stan Wullschleger, Charles Garten Jr., and Anthony Palumbo, "Laser-induced Breakdown Spectroscopy for the Environmental Determination of Total Carbon and Nitrogen in Soils," accepted to the Special issue of Applied Optics, focused on "Laser Applications to Chemical and Environmental Analysis".

Madhavi Martin, Stan Wullschleger, and Charles Garten Jr., "Laser-induced breakdown spectroscopy for environmental monitoring of soil carbon and nitrogen," Proceedings of SPIE, Eds. Tuan Vo-Dinh and Stephanus Buttgenbach, vol 4576, pp. 188-195 (2002).

M. D. Cheng and M. Z. Martin (2000) Development of A Field Portable Aerosol Beam-Focused Laser-Induced Plasma Emission Spectrometer for Aerosol Measurement, *Aerosol Sci. & Technol.*

Martin, M. Z. and M. D. Cheng, "The Detection of Chromium Aerosol using Time-Resolved Laser-Induced Plasma Spectroscopy," *Appl. Spectrosc.*, **54**(9) (2000) .

Martin, M. Z., M. D. Cheng, and R. C. Martin, "Aerosol Measurement by Laser-Induced Plasma Technique: A Review," *Aerosol Sci. and Technol.*, **31**(6) (1999) 409-421.

M. Z. Martin, S. R. Desai, C. S. Feigerle, and J. C. Miller, "Chemistry in Clusters: Synthesis of NO⁺(N₂O₃)_n and NO₂⁺(N₂O₃)_n Species," *J. Phys. Chem.*, **100** (1996) 8170-74.

L. A. Pinnaduwege, M. Z. Martin, and L. G. Christophorou, "Enhanced Negative Ion Formation in ArF-Laser-Irradiated Methane: Possible Implications for Plasma Processing Discharges," *IEEE Trans. Plasma Sci.*, **35** (1995) 433-38.

M. Z. Martin and A. A. Garrison, "Optical pH-Sensor - A Tool for On-line Chemical Process Control," *AT-PROCESS: J. Process Anal. Chem.*, (1994) 127-131.

A. A. Garrison and M. Z. Martin, "Acid Sensing by Remote Raman Spectroscopy," *AT-PROCESS: J. Process Anal. Chem.*, (1994) 95-98.

L. A. Pinnaduwege, M. Z. Martin, and L. G. Christophorou, "Enhanced Negative Ion Formation in UV-Laser-Irradiated Silane; Implications for Plasma Deposition of Amorphous Silicon," *Appl. Phys. Letters*, **65** (1994) 2571-73.

M. Z. Martin, F. K. Oshita, M. Matloubian, H. R. Fetterman, W. J. Ho, N. L. Wang, F. Chang, and D. Cheung, "The Electrical and Optical Response of a Very High Frequency AlGaAs/GaAs Heterojunction Bipolar Transistor," *J. Appl. Phys.*, **76** (1994) 3847-49.

M. Z. Martin, A. A. Garrison, M. J. Roberts, P. D. Hall, and C. F. Moore, "Composition monitoring by on-line remote Raman spectroscopy," *Process Control and Quality*, **5** (1993) 187-92; invited talk at Seventh International Forum Process Analytical Chemistry, Galveston, Texas, Jan. 26-27, 1993.

R. C. Martin and M. Z. Martin, "Analytical Techniques for SiC Characterization: Literature Review and Project Status," Oak Ridge National Laboratory Report ORNL/TM-12352, Nov. 1993.

M. Z. Martin, F. K. Oshita, M. Matloubian, H. R. Fetterman, L. Shaw, and K. L. Tan, "High-Speed Optical Response of Pseudomorphic InGaAs High Electron Mobility Transistors," *IEEE Photonics Technology Letters*, **4** (1992) 1012-14.

F. Oshita, M. Martin, M. Matloubian, H. Fetterman, H. Wang, K. Tan, and D. Streit, "Cryogenic Performance of a Monolithic W-Band Amplifier Using Picosecond Optoelectronic Technique," *IEEE Microwave and Guided Wave Letters*, **2** (1992) 340-42.

Madhavi Z. Martin, D. K. Shuh, R. S. Williams, and R. M. Ostrum, "Transport Properties and Infrared Spectra of CuCl Thin Films," *J. Appl. Phys.*, **67** (1990) 3097-3101.

Madhavi Zope, B. D. Muragi, and J. K. Zope, "Electrical Conductivity Measurements in a Ge-Se-Tl System," *J. Non-Crystalline Solids*, **103** (1988) 195-200.

Madhavi J. Zope and J. K. Zope, "Effect of γ -Irradiation on Non-Linear I-V Behaviour and Thermoelectric Measurements in Amorphous Semiconducting As-Se-Te System," *J. Non-Crystalline Solids*, **74** (1985) 47-55.

Madhavi J. Zope and J. K. Zope, "Nonlinear I-V Behaviour and Thermoelectric Measurements in Amorphous Semiconducting As-Te-I System," *Indian J. Pure & Appl. Physics*, **23** (1985) 68-70.

Madhavi J. Zope and J. K. Zope, "Nonlinear I-V Behaviour and Conductivity Measurements in Amorphous Semiconducting Ge-As-Te System," *J. Mat. Sci. Lett.*, **3** (1984) 850-52.

PRESENTATIONS

Madhavi Martin, Barbara Evans, Hugh O'Neill, and Jonathan Woodward, "Laser-Induced Breakdown Spectroscopy used to Detect Palladium metal Dispersed in Cellulose Membranes," Presented at Laser-Induced Plasma Spectroscopy and Applications (LIBS2002) conference, 9/24/02-9/28/02, Caribe Royale, Lake Buena Vista, Florida.

Madhavi Martin, Stan Wullschleger, Charles Garten Jr., and Anthony Palumbo, "Environmental Monitoring of Total Carbon and Nitrogen in Soils using Laser-Induced Breakdown Spectroscopy," Presented at Laser-Induced Plasma Spectroscopy and Applications (LIBS2002) conference, 9/24/02-9/28/02, Caribe Royale, Lake Buena Vista, Florida.

Madhavi Martin, Stan Wullschleger, Charles Garten Jr., Anthony Palumbo, Barbara Evans, Hugh O'Neill, and Jonathan Woodward, "Environmental and biological applications of Laser-induced breakdown spectroscopy," presented at the Workshop on Advances in Laser Technology and Applications held August 21 & 22, 2002 at Redstone Arsenal AL.

Madhavi Martin and Stan Wullschleger, "An Overview of the Current Technologies used in the Environmental Monitoring of Soil Carbon," Proc. International Symposium on Environmental and Industrial Sensing, 28 Oct -2 Nov, 2001, Boston, MA SPIE Vol. 4574.

Cheng, M. D., and M. Z. Martin, and T. Wainman (1999) A Field Portable Monitor for Real-Time Measurement of Elements on Aerosols, *the Annual Symposium of SERDP Program*, Crystal City, Washington, DC, 11/29-12/3.

M. Z. Martin and M. D. Cheng, "Laser-Induced plasma spectroscopy (LIPS): A tool for in situ spectroscopic characterization of aerosol mercury and chromium," CLEO/QELS Meeting, Baltimore, Md, May 23-28, 1999.

M. Z. Martin and M. D. Cheng, "Detection of Chromium and Mercury in Aerosols using Laser-Induced Plasma Spectroscopy: Wavelength and Buffer Gas Dependence," APS Centennial Meeting, Atlanta, Ga, March 20-26, 1999.

Cheng, M. D. and M. Z. Martin (1998) *Real-Time Measurement of Fine Particles and Trace Elements by Means of Laser-Induced Plasma Spectroscopic Technique*, the Conference on Air Quality, Mercury, Trace Elements, and Particulate Matter, 12/1-4, held in McLean, VA, *Invited*.

Jun Xu, Chung-Yi Kung, Madhavi Martin, William B. Whitten, and J. Michael Ramsey, "Studies of Miniature Ion Mobility Spectrometer," International Conference on Ion Mobility Spectrometry, Hilton Head, SC, September 14-18, 1998.

M. Z. Martin, L. Liu, C. S. Feigerle, and J. C. Miller, "Multiphoton Ionization Studies of Laser Induced Chemistry in Clusters," Resonance Ionization Spectroscopy Meeting, State College, Pa., June 30 - July 5, 1996.

M. Z. Martin, S. R. Desai, C. S. Feigerle, and J. C. Miller, "Laser-Induced Chemistry within Clusters," presented at Laser Applications to Chemical and Environmental Analysis," Orlando, Fl., March 20-22, 1996.

M. Z. Martin, S. R. Desai, C. S. Feigerle, and J. C. Miller, "Laser Ionization Mass Spectrometry of $(N_xO_y)_n$ Clusters," presented at the International Symposium on the Science and Technology of Atomically Engineered Materials, Richmond, Va., October 30 - November 4, 1995 (winner of *Best Poster Award*).

L. A. Pinnaduwege, M. Z. Martin, and L. G. Christophorou, "Efficient Negative Ion Formation in UV-Laser-Irradiated Silane; Implications for Plasma Deposition Applications," presented at the 47th Annual Gaseous Electronics Conference, Washington, D.C., October 18-21, 1994.

A. A. Garrison, M. Z. Martin, and M. J. Roberts, "Raman Spectroscopy - Academic Laboratory to the Process," presented at Pittcon '94, the Pittsburgh Conference & Exposition on Analytical Chemistry & Applied Spectroscopy, Chicago, Ill., February 28 - March 4, 1994.

A. A. Garrison and M. Z. Martin, "Fourier transform Raman spectroscopy - application to process control," Proc. 9th International Conference on Fourier Transform Spectroscopy, August 23-27, 1993, Calgary, Alberta, Canada, SPIE Vol. 2089, 210-11.

M. Martin, F. Oshita, M. Matloubian, and H. Fetterman, "Picosecond Optoelectronic Characterization of AlGaAs/GaAs HBT at Cryogenic Temperatures," Proceedings of the 1991 International Semiconductor Device Research Symposium, Charlottesville, Va., December 4-6, 1991, pp. 391-94.

F. Oshita, M. Martin, M. Matloubian, and H. Fetterman, "Picosecond Testing of Three-Terminal Devices," National Center for Integrated Photonic Technology, Second Workshop, Lake Arrowhead, Cal., November 11-12, 1991.

F. Oshita, M. Martin, M. Matloubian, and H. Fetterman, "Picosecond Optoelectronic Testing," Jet Propulsion Laboratory Conference on Optical Applications to Microwave and Millimeter-Wave Systems, Pasadena, Cal., October 8, 1991.

H. R. Fetterman, M. Matloubian, D. V. Plant, M. Martin, and F. Oshita, "Picosecond Testing and Evaluation of Three Terminal Devices," IEEE LEOS 1991 Summer Topical Meeting on Optical Millimeter-Wave Interactions, Newport Beach, Cal., July 24-26, 1991, pp. 11-12 (invited talk).