# RUBY NANDINI GHOSH

Research Associate Professor
Department of Physics and Astronomy
Michigan State University

4218 BioMed Physical Sciences
Michigan State University
East Lansing, MI 48824

Tel (517) 884 5585
FAX (517) 353 4500
ghosh@pa.msu.edu

## EDUCATION

**Cornell University**, Ithaca, New York, Ph.D. Applied & Engineering Physics (1991)
*Thesis*: "Spin Dependent Transport in a Silicon Two-Dimensional Electron Gas"

**Cornell University**, Ithaca, New York, M.S. Applied & Engineering Physics, (1986)
*Thesis*: "Monolithic Integration of GaAs Light-Emitting Diodes and Si Field-Effect Transistors"

**Swarthmore College**, Pennsylvania, B.A. with honors, Physics (1982)

## PROFESSIONAL EXPERIENCE

**Research Associate Professor**, *Dept. of Physics, Michigan State University* 2004 to present
**Research Faculty,** *Center for Sensor Materials, Michigan State University* 1996 to 2004

"Wide bandgap semiconductor devices"

Catalytic gate silicon carbide devices have been developed for detection of hydrogen containing gases in high temperature, harsh environments. Studying the defect dynamics of interfaces in metal-dielectric–SiC field–effect structures. Demonstrated ms response time for sensors operating at 600 °C during continuous operation for several weeks with negligible degradation in performance.

"Fiber optic oxygen sensing"

Developed a reflection mode fiber probe operating in a 0 - 20% gaseous oxygen atmosphere by utilizing the quenching of the phosphorescence from molybdenum chloride clusters by $^3O_2$. Studying the photophysics of Mo-clusters for spatially ($\leq$50 μm) and temporally ($\leq$1s) resolved measurements. Demonstrated 24/7 outdoor monitoring of dissolved oxygen in aqueous biological media.

"Remote identification of chemical components in structural fires

Developing a library of chemical burn signatures of the major constituents present in structural fires. for remote, wireless fire safety applications.

**Member of Technical Staff**, *Bell Laboratories, Murray Hill, New Jersey* 1994 to 1996
Planar Lightguide Circuit Research Department, Lucent Technologies ,
"$Er^{3+}$ - doped planar waveguide amplifier"

Investigated the integration of active optical elements with passive silica optical circuits. Demonstrated an $Er^{3+}$ waveguide amplifier, pumped by a semiconductor diode laser, with the lowest threshold to date of 8mW and a net gain of 4.5 dB.

**Postdoctoral Fellow** *National Institute of Standards and Technology, Gaithersburg* 1991- 1994
Fundamental Electrical Measurements Group, Electricity Division
"Precision measurements with single electron tunneling structures"

Developed a new technique to measure the electronic charge e, by counting electrons on a capacitor. Fabricated single electron tunneling (SET) devices. Investigated using an SET electrometer in a capacitance bridge to measure the leakage rate of a capacitor at 10 mK.

**Graduate Assistant**, *Cornell University, Ithaca, New York*
Research Assistant, Laboratory Atomic & Solid State Physics 1986 to 1991
*Advisor*: Robert H. Silsbee
Research Assistant, Department of Electrical Engineering 1983 to 1986
*Advisor*: Joseph M. Ballantyne

## SYNERGISTIC ACTIVITIES

| | |
|---|---|
| Meetings: | America's co-chair, IEEE Sensors 2009, Christchurch, New Zealand<br>America's co-chair, IEEE Sensors 2005, Irvine, USA<br>Tech. program Committee, IEEE Sensors 2007, 2004 and 2003<br>Tech. program Committe, 2008 Int. Mtg. Chemical Sensor, Columbus, USA |
| Reviewer | National Research Council Review Panel for the National Institute of Standards Technology 2004-2008 |
| Referee: | IEEE Photonics Technology Letters, Cryogenics, IEEE Sensors Journal, IEEE Trans. Elec. Device J. Appl. Physics |

## RECENT COLLABORATIONS

Dr. Jay Grate, *Pacific Northwest Laboratory*
Prof. Indrek Wichman, *Michigan State University*
Dr. James Wynn, *MBI*
Prof. Chris Xu, *Cornell University*

## TEN RELEVANT PUBLICATIONS


R. N. Ghosh, P. A. Askeland, S. Kramer and R. Loloee, "Optical dissolved oxygen sensor utilizing molybdenum chloride cluster phosphorescence", App. Phys. Lett. **98**, 221103 (2011)

R. N. Ghosh, I. S. Wichman, C. A. Kramer and R. Loloee, "Time resolved measurements of pyrolysis and combustion products of PMMA", accepted for publication in Fire and Materials (2012)..

R. N. Ghosh, G. L. Baker, C. Ruud and D. G. Nocera, "Fiber optic oxygen sensor using molybdenum chloride cluster luminescence", App. Phys. Lett. **75**, 2885-2887 (1999)

R. Loloee, B. Chorpening, S. Beer, R. N. Ghosh, "Hydrogen monitoring for power plant applications using SiC sensors", Sens. Actuators B. Chem. **129** (1), 200-210 (2008.)

P. Tobias, B. Golding and R. N. Ghosh, "Interface states in high temperature gas sensors based on silicon carbide", IEEE Sensors J., **3** (5), 543-7 (2003).

R. N. Ghosh & P. Tobias, "SiC field-effect devices operating at high temperature", J. Elec. Mat., **34** (4), 345-350 (2005)

M. S. Crosser, S. H. Tessmer and R. N. Ghosh, "Scanning electric field sensing for semiconductor dopant profiling", Appl. Surf. Sci. **195** (1-4), 146-154 (2002).

R. N. Ghosh, C. F. Kane, M. R. X. Barros, G. Nykolak, A. J. Bruce and P. C. Becker, "8mW Threshold Er3+-doped planar waveguide amplifier", , IEEE Phot. Tech. Lett. 8, 518-520, (1996).

R. N. Ghosh and R. H. Silsbee, "Spin dependent transport in a two-dimensional electron gas", Sol. St. Comm. **81** (7), p. 545-548 (1992).

R. N. Ghosh, B. Griffing and J. M. Ballantyne" Monolithic integration of GaAs light-emitting diodes and Si metal-oxide-semiconductor field-effect transistors", Appl. Phys. Lett. **48** (5), 370-371, (1986).


## RECENT PATENTS


G. L. Baker, R. N. Ghosh & D. J. Osborn, "Sol-gel encapsulated hexanuclear clusters for oxygen sensing by optical techniques", US Patent 7,858,380 B2 (2010).

R. N. Ghosh, R. Loloee, P. A. Askeland & C. Weeks "Optical sensing system for oxygen monitoring in aqueous media using Molybdenum cluster phosphorescence" US Prov. Pat. 61/410,254 (filed Nov. 2010).

G. J. Brereton, H. J. Schock, R. N. Ghosh and F. M. Salam, "Sensors and method for measurement of flow rates and cumulative flow in ducts", U. S. Patent # 6,408,698 B1 (2002).


## ADVISEES

*Postgraduate*: M. S. Crosser, Linfield College, Oregon (2006); P. Zhang, Linn State College, Missouri (2007); P. Tobias, Honeywell, Minneapolis (2005), S. G. Ejakov, Ford, Michigan (2002)
*Undergraduate:* S. K. Kramer; C. A. Kramer, J. Olds