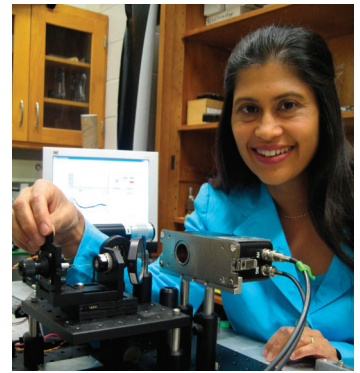


Optical image of SiC sensor chip with an array of Pt/SiO₂/SiC devices (200 to 1000 μm) operating at 630 °C in air.

Silicon Carbide

The wide bandgap semiconductor SiC is a fascinating material, our interest is in the electronic and chemical properties of field-effect devices. We have developed a catalytic gate hydrogen sensor with millisecond response at 600 °C, capable of continuous operation for several months in a power plant. Our group is studying the hydrogen mediated defect dynamics at interfaces in refractory metal/oxide/SiC field-effect structures. Sensitive, rugged sensors capable of quantitatively monitoring the gaseous products of combustion systems are needed for reducing polluting emissions and improving energy efficiency.



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SELECTED PUBLICATIONS

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

P. Tobias, S. Ejakov, B. Golding and R. N. Ghosh, "Interface states in high temperature gas sensors based on silicon carbide", invited issue *IEEE Sensors J.*, 2, p. 543 - 547 (2003).

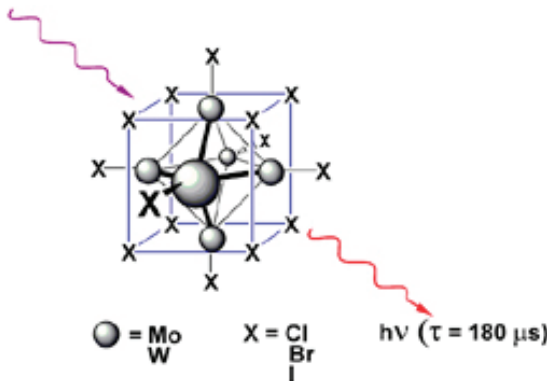
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C. Kramer, R. Loloee, I.S. Wichman and R. N. Ghosh "Time resolved measurements of pyrolysis products from thermoplastic PMMA", *Proc. ASME IMEC*, paper 11256 (2009)

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

Optics

Metal-halide cluster such as Mo₆Cl₁₂ and related compounds, emit a bright red (600-900 nm) phosphorescence when pumped with UV photons. The emission is efficiently quenched by oxygen molecules in their ground state, ³O₂. The specificity of these indicators to oxygen is determined by quantum mechanics; we are studying the photophysics and material properties of MoCl clusters immobilized in sol-gel and polymer matrices for gas and liquid phase sensing. Applications of our fiber optic sensor include monitoring dissolved oxygen in outdoor fish hatcheries over several months and oxygen containing gas mixtures from 20 to 100 °C. A spatially (~ 50 μm) and temporally resolved (~1 s) oxygen imaging technique for bio-medical applications is under development.



Fire Research

The ability to remotely identify the chemical components in structural fires is an invaluable tool for first responders. We are developing a data base of the chemical burn signature of the major constituents present in structural fires. These "chemical fingerprints" obtained from well controlled thermal decomposition experiments, as the material pyrolysis and eventually self combusts, will enable remote, wireless fire monitoring.