Carnegie Mellon
Materials Science and Engineering Seminar Series

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Laboratory for Surface Science & Technology
University of Maine

"Thin Film Materials for High Temperature Sensor Applications"

Friday, April 24, 2009
11:30AM Seminar in Baker Hall 136A

A critical need exists for sensors that can monitor physical quantities such as temperature, pressure, strain, and corrosion at strategic locations of components operating in harsh environments up to 1000°C. Stable sensor materials and robust packaging must be developed so that the sensors can withstand these demanding environments and be used effectively in applications such as aircraft turbine engines, power plants, automotive diagnostics, and industrial process control. We have developed surface acoustic wave (SAW) sensors based on langasite ($La_3Ga_5SiO_{14}$) piezoelectric crystals that remain stable to at least 900°C. A major challenge for this technology is to develop oxidation resistant metallic electrodes and ultra-thin passivation coatings that can mechanically protect the active sensor surface, yet allow interaction with the environment. This talk will discuss the synthesis and properties of nanostructured Pt-Rh/ZrO_2 thin film electrodes and ultra-thin SiAlON and ZrSiN passivation coatings, as well as show results from prototype SAW sensor devices operating at high temperatures.

Robert J. Lad is a Professor of Physics at the University of Maine and the Director of the Laboratory for Surface Science & Technology, an interdisciplinary research center that focuses on nanotechnology and sensor technology. Since joining UMaine in 1988, he has received more than 40 grants to support his research programs on surface, interfacial, and thin film properties of ceramic and semiconductor materials**.** He obtained a B.S. in Materials Engineering from Northwestern University in 1980, and Ph.D. in Materials Science from Cornell University in 1986 working on high temperature gaseous corrosion of metallic alloys. He also was a Postdoctoral Associate in the Department of Applied Physics at Yale University where he studied the surface science and electronic structure of metal oxides.