



SPRING 2006 SEMINAR SERIES

**TUNING THE OPTICAL AND RADIATION PROPERTIES OF MATERIAL
USING NANOBUBBLES**

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This seminar aims at investigating the possibility of tuning the optical and radiation properties of dense material by introducing nanopores. The pores can be closed or open and have various shapes, sizes, orientations, and concentrations. Applications range from optoelectronics, membrane sciences, and thermal barrier coating to low-k dielectric materials and photo-biosensors. In order to effectively design, utilize, and/or characterize nanoporous media for these various applications, models that describe their optical properties are necessary.

First, experimental data reported in the literature for dielectric constant and index of refraction of nanoporous media are reviewed and compared with various effective property models commonly used in the literature. Large differences are found and will be discussed. Then, recent results from numerical experiments are presented. Simulations consist of solving the Maxwell's equations in both non-absorbing and absorbing nanoporous thin-films. The materials of interest are porous silicon and silicon dioxide. The pore diameter ranged between 1 and 100nm with thin-film thickness varying between 2 nm and 40 μm . In addition, various pore shapes, spatial arrangements, and concentrations are investigated. All interfaces are assumed to be optically smooth and characteristic pore size is much smaller than the wavelength of incident radiation so electromagnetic wave scattering by pores can be safely neglected. An inverse method is then used to retrieve the effective index of refraction and absorption index from the interference pattern. The numerical results are then compared with the Maxwell-Garnett, Bruggeman, parallel, and series models. Particular attention is also given to a recent model obtained by applying the Volume Averaging Theory (VAT) to the Maxwell's equations.

Bio: Laurent Pilon joined the Mechanical and Aerospace Engineering Department at UCLA as Assistant Professor in 2002. He received his B.S. and M.S. in 1997 in Applied Physics from the Grenoble National Polytechnic Institute, France. He worked for two years for the French Atomic Energy Commission before starting his doctoral studies at Purdue University. He graduated from in 2002 with a PhD in Mechanical Engineering. He is the recipient of the 2003 UCLA Faculty Development Award, the 2005 NSF CAREER Award, and the 2005 Northrop Grumman Excellence in Teaching Award.

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Refreshments will be served starting at 3:00 pm.

THURSDAY, APRIL 27, 2005
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3:30 PM - 4:30 PM