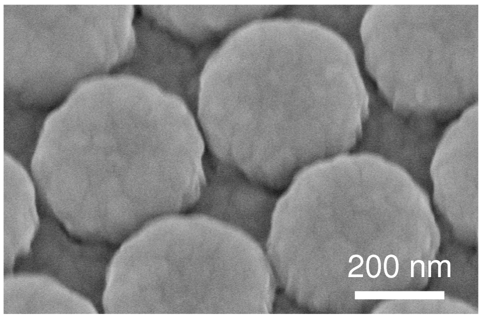
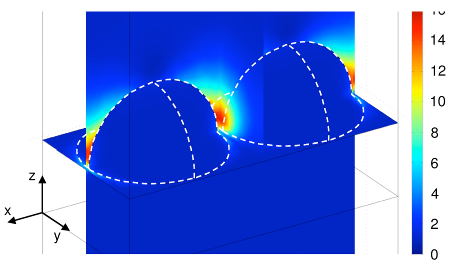
NANOHOUR

Wednesday, May 5, 2010 3:00 pm
Beckman Institute - Room 3269

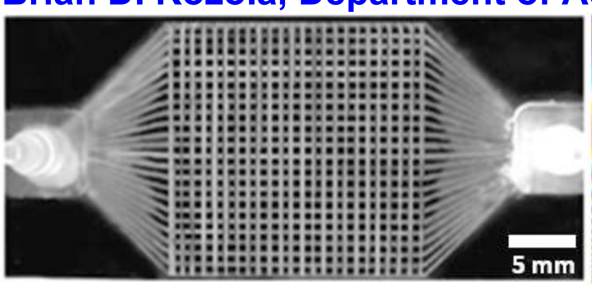
Surface-Enhanced Raman Scattering Nanodomes
Charles J. Choi, Dept. of Electrical and Computer Engineering

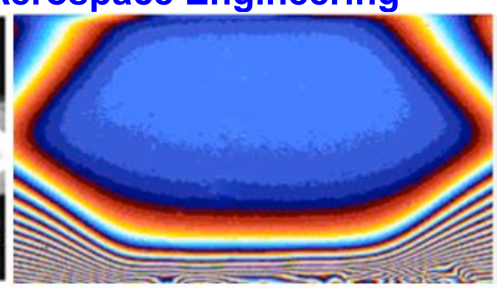




We demonstrate a surface-enhanced Raman scattering (SERS) substrate consisting of a closely spaced metal nanodome array fabricated on flexible plastic film using a low cost, large area replica molding process to produce a 2-dimensional periodic array of cylinders that is subsequently overcoated with SiO_2 and silver thin films to form dome structures. Finite element modeling was used to investigate the electromagnetic field distribution of the nanodome array structure and the effect of the nanodome separation distance on the electromagnetic field enhancement. The SERS enhancement from the nanodome array substrates was experimentally verified using rhodamine 6G (R6G) as the analyte. With a minimum separation distance of 17 nm achieved between adjacent domes using a process that is precisely controlled during thin film deposition, a reproducible SERS enhancement factor of $\sim 10^8$ was demonstrated. The nanoreplica molding process presented in this work allows for simple, low cost, high-throughput fabrication of nanoscale features over large surface areas without the requirement for high resolution lithography or defect-free deposition of spherical microparticle monolayer templates.

Structural Cooling via Embedded Microvascular Networks
Brian D. Kozola, Department of Aerospace Engineering





Materials incorporating microvascular circulatory networks represent a new approach to multifunctional structural materials. Embedded vascular networks exploit the unique thermal advantages of the microscale to create polymer structures with efficient internal thermal management capabilities. Complex two and three dimensional networks are embedded directly into a structural epoxy matrix using robotically controlled deposition (RCD) of a fugitive organic ink. The network channels are cylindrical in shape and range in diameter from 200 to 410 mm. The two dimensional networks include an array of identical parallel channels while the three dimensional networks consist of stacked layers of channels with vertical interconnects between layers. The thermal performance of specimens was evaluated using an infrared camera imaging fin specimens on a heated plate. The flow distribution in each specimen was further investigated using a micro-Particle Image Velocimetry (m-PIV) technique capable of discerning the flow profile in individual channels.

The RCD fabrication process can also be leveraged to create biologically-inspired, thermally responsive networks through the integration of temperature sensing, control, and actuation components. This type system adaptively routes coolant flow to areas of high local heat flux and balances pressure drop and cooling efficiency. We ultimately envision structural composites that are cooled efficiently by circulating coolants within an adaptive three-dimensional interconnected system of microchannels.

Coffee and cookies will be served

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