Northeastern University
College *of* Engineering

Please join us for a
Special Chemical Engineering Seminar

Friday, December 7, 2012
108 West Village H
11:45 a.m. – 1:00 p.m.

"Electrophoretic Deposition of Nanoporous Surface Coatings with Extreme Wettability"

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ABSTRACT

In electrophoretic deposition (EPD) an applied electric field is used to deposit particles from colloidal suspensions onto porous or conductive substrates. We've recently shown that EPD can be used to fabricate superhydrophobic surfaces with static contact angles exceeding 160^{o}. By slightly modifying the process, we've also demonstrated highly wettable surfaces as characterized by capillary rise measurements. In this talk we will discuss recent efforts to design and characterize our superhydrophobic and superhydrophilic surfaces created with EPD. For superhydrophoilic surfaces, we combine break down anodization with EPD to yield coatings with microscale and nanoscale features and favorable transport properties for liquid water. Additionally, we have explored drop impingement on our nanoporous superhydrophilic surfaces and identified multiple droplet impingement modes. We denote observed impingement modes as 'necking' (droplet breaks before full penetration in the porous surface), 'spreading' (continuous wicking into the porous surface), and 'jetting' (jets of liquid emanate from the edges of the wicking liquid). To predict the droplet impingement modes, we've developed a new non-dimensional parameter that is a function of droplet velocity, dynamic viscosity, effective pore radius and contact angle. The novel dimensionless parameter successfully predicts drop impingement modes across multiple fluids and droplet velocities.

BIOGRAPHY: Dr. Cullen R. Buie is the Mitsui Career Development Chair and Assistant Professor of Mechanical Engineering at MIT. Cullen grew up in Shaker Heights, Ohio and attended The Ohio State University where he received his B.S. in Mechanical Engineering (2003). After OSU, Cullen attended Stanford University as a National Science Foundation Graduate Research Fellow and obtained his M.S. (2005) and Ph.D. (2009) in Mechanical Engineering. Cullen's Ph.D. research, with Professor Juan Santiago, involved the study of microfluidic pumps to manage liquid water in proton exchange membrane fuel cells. After Stanford, Cullen spent a year at UC Berkeley working with Professor Liwei Lin and Professor John Coates as a UC President's Postdoctoral Fellow. At MIT his laboratory explores fundamentals of electrokinetic phenomena for application in materials science and microbiology. His research is applicable to a diverse array of problems, from anti-biofouling surfaces and biofuels to energy storage and bacterial infections. Cullen is the recipient of numerous awards for his research and service including the National Science Foundation CAREER Award (2012).

Refreshments will be served