Abstract
A polymer brush is a dense monolayer of highly stretched polymer chains that are anchored to a surface by one end and extend away from that surface into the solution that bathes it. Historically, polymer brushes have been of interest for their potential to overcome van der Waals attractions and stabilize particulate suspensions against aggregation, and in the case of particular polymer chemistries, to improve the biocompatibility of a material. One of the major challenges in the technological deployment of polymer brushes has been the difficulty of creating brushes with sufficiently large numbers of polymer chains attached per unit surface area. The recent development of “grafting from” methods of polymer brush formation by polymerization from surface-bound initiators now makes it possible to create brush-decorated surfaces with large and controlled grafting densities. We use the grafting from method to produce dense polymer brushes on nanoparticles. Such particles have proven to be extremely effective emulsifying agents by virtue of their high affinity adsorption to oil droplet/water interfaces and their ability to stabilize those interfaces. The emulsification performance of such particles, including the ability of some nanoparticles to stabilize emulsions for over year using less than 0.01 wt% nanoparticle concentrations will be discussed. Complimentary measurements of nanoparticle adsorption to fluid interfaces and its effect on interfacial tension and elasticity will be discussed to help interpret this high degree of emulsification efficiency. This seminar focuses mainly on nanoparticles at fluid interfaces, but other applications of these polymer-grafted nanoparticles being developed for solid/liquid interfacial systems will be discussed briefly as well.

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Biosketch
Professor Tilton has been a member of the Chemical Engineering faculty of Carnegie Mellon University since 1992. In 2004 he accepted a joint appointment in Biomedical Engineering. He earned the B.Ch.E. from the University of Delaware in 1986, and the M.S. and Ph.D. in Chemical Engineering from Stanford University in 1987 and 1991, respectively.

Professor Tilton currently serves as Director of Carnegie Mellon’s Center for Complex Fluids Engineering. His research focuses on the nanometer-scale forces and structures that govern the macroscopic performance properties of complex fluids and colloidal systems. This theme links fundamental work, for example on mechanisms of complexation and co-adsorption of polymers and surfactants, to more applied work, for example on the development of nanoparticles engineered for use as emulsifiers or as environmental remediation agents, and the development of surfactant systems for enhanced pulmonary drug delivery.