Abstract. In this talk, we discuss two important themes in contemporary polymer science: nanoscale confinement effects on polymer properties and new routes of processing nanomaterials, i.e., nanoparticles. Concerning the former, significant effort has been devoted to pursuing an understanding of the glass transition temperature of polymers confined to the nanoscale. Much of our understanding has been obtained via studies on thin polymer films. Here, we show the glass transition temperature of polymer nanoparticles can deviate significantly from the bulk value. Our work suggests a common origin of size effects of the glassy properties of confined polymers, irrespective of geometry, that is, interfacial effects. We also discuss the influence of surfactants and the dispersing media on the glass transition temperature and fragility of polymer nanoparticles. With regards to the later theme, aside from polymerization techniques, polymer nanoparticles can be generated through the displacement of a solvent with a nonsolvent, i.e., nanoprecipitation. Here, we present a facile process termed Flash NanoPrecipitation (FNP) to generate homogeneous and heterogeneous polymer nanoparticles. As compared to polymer nanoparticles synthesized by surfactant free emulsion polymerization, nanoparticles prepared by FNP show comparable size distributions when the diameter is less than 150 nm. Furthermore, we illustrate that the sizes of polymer nanoparticles prepared by FNP can be fine-tuned by changing the polymer and/or electrolyte concentration. Calculations of the mechanism of particle formation and stabilization show that the size-dependent electrostatic repulsions between nanoparticles and nanoparticles versus single collapsed polymer chains control assembly and monodispersity. We also discuss recent developments of the FNP process to form polymer-polymer Janus nanoparticles and metal-polymer supported nanoparticles. Lastly, we discuss a one-step polymerization based approach to form nanostructured templates to create yolk-shell nanoparticles.

Biography. Rodney D. Priestley is an Assistant Professor in the Department of Chemical and Biological Engineering at Princeton University. He obtained his Ph.D. in Chemical Engineering from Northwestern University in 2008. He completed an NSF/Chateaubriand postdoctoral fellowship at Ecole Superieure de Physique et Chimie Industrielles de la Ville de Paris. His research interests include polymer glasses, nanoconfined polymer dynamics, polymer thin film and nanoparticle formation, MAPLE and responsive polymers. He is the recipient of the Quadrant Award, an international award given for excellence in academic achievement and scientific research in polymer science and engineering, the ACS New Investigator Grant, the 3M Non-Tenured Faculty Grant, the NSF CAREER Award, and an AFOSR YIP Award. Rodney recently received the Wentz Junior Faculty Award from the School of Engineering and Applied Science at Princeton University, the Presidential Early Career Award for Scientist and Engineers, and was named a 2013 Diverse Emerging Scholar and 2014 Alfred P. Sloan Research Fellow.