

2012 Metzner Early Career Award: Charles M. Schroeder III

Charles Schroeder, Assistant Professor of Chemical & Biomolecular Engineering and Materials Science and Engineering at the University of Illinois at Urbana-Champaign (UIUC), has been awarded the 2012 *Arthur B. Metzner Early Career Award* of the Society of Rheology. This award singles out a Society member younger than 35 who has distinguished him/herself in rheological research, rheological practice, or service to rheology.

Schroeder received his B.S. in Chemical Engineering from Carnegie Mellon University and his M.S. and Ph.D. in Chemical Engineering from Stanford University. During his graduate research with Eric Shaqfeh (2011 Bingham Medalist), Schroeder studied polymer conformation hysteresis and the role of intramolecular hydrodynamic interactions on polymer dynamics using Brownian dynamics simulations. At Stanford he studied the dynamics of single DNA molecules in non-equilibrium fluid flows under the supervision of Steven Chu. Schroeder spent a postdoctoral year at Harvard working with X. Sunney Xie; at Harvard, Schroeder developed a hydrodynamic flow-based assay to study DNA-protein interactions. Since 2008 Schroeder has been on the faculty of the University of Illinois at Urbana-Champaign.

At the University of Illinois, Schroeder recently extended the field of molecular rheology to a new class of polymeric materials, truly flexible polymers. Previously, single polymer studies were limited to double stranded DNA, which is a semiflexible polymer. Synthetic polymers of commercial relevance are much more flexible than these models, and Schroeder and his group have developed a versatile chemical platform to synthesize chemically-modified single-stranded DNA of any “designer” sequence with concomitant labeling

of the polymer backbone with a fluorescent dye. The dyed segments allow the group to observe relaxation dynamics of single flexible chains, and Schroeder and his group have demonstrated that relaxation processes follow a fundamentally different route than has been assumed previously. “The results of his studies will transform our understanding of polymer chain dynamics and rheology,” according to his nominator, Charles Zukoski of the University of Illinois.



Schroeder’s group recently developed a new theoretical framework that allows for determination of materials properties (e.g. polymer elasticity) from far-from-equilibrium measurements (e.g. polymer dynamics). This theoretical development is a first-of-its-kind tool in the field of complex fluids/soft materials and offers a powerful new approach to extract materials properties.

Finally, Schroeder’s group recently developed a new method to confine and manipulate single nanoparticles in free solution using the sole action of hydrodynamic forces in a microfluidic device. The “microfluidic trap” is based on active flow field control at a fluid stagnation point, which enables particle confinement of small nanoparticles for long times.

Taken together, Schroeder’s work combines elegant experimental work with rigorous analysis — just the tools needed to advance rheology. Charles Schroeder thus exemplifies the excellence that has been come to be expected from those singled out for the Metzner Award. Charles Schroeder is the fourth recipient of the *SOR Early Career Award*; the plaque and prize associated with the Metzner Award will be presented to Schroeder in Pasadena in February 2013.



Profile by Faith Morrison
and Charles Zukoski



The *SOR Early Career Award*, established in 2009, is named for Art Metzner, distinguished rheologist, university professor, editor of the *Journal of Rheology*, and Bingham medalist.