北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

The quest in polymer rheology, from viscoelasticity to melt fractureWhat is beyond Maxwell's and de Gennes' paradigms?

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Time: 10:00am, June 13, 2013(Thursday)

时间：2013年6月13日（周四）上午10:00

Venue: Conference Room 607, Science Building 5

地点：理科五号楼607会议室

Abstract

Clark Maxwell's approach to linear viscoelasticity inspired the establishment of continuum mechanics based on constitutive equations for complex systems including softer matter, where the Navier-Stokes equation for viscous liquid is the best known example. Pierre-Giles de Gennes proposed the idea of reptation[1] to depict the molecular origin of linear viscoelasticity in entangled polymers, giving birth to a new molecular-rheology paradigm upon which to build a first-principles like theory known as the tube model.[2] For three decades (1978-2006), this theoretical framework was thought to have provided an adequate description of everything we know about large deformation and flow behavior of polymeric liquids. The emerging phenomenology since 2006 has shaken our confidence in the molecular interpretations owing to the tube model. This seminar details the experimental findings based on particle-tracking velocimetric observations and elucidates an alternative conceptual foundation. Specifically, it is emphasized that the intermolecular interactions are network like, i.e., point-like, arising from the chain uncrossability, and play an active role to influence nonlinear responses of entangled polymers (Macromolecules **2013**, *46*, 3147). In contrast, the tube model's smoothed-out treatment of the intermolecular interactions in terms of an imaginative tube appears to be a gross oversimplification and cannot explore the physics that dictates when the external deformation becomes non-affine, i.e., when molecular yielding takes place.

1. P. G. de Gennes, *J. Chem. Phys.* **55**, 572 (1971), cited over 2500.

2. M. Doi and S. F. Edwards, *The Theory of Polymer Dynamics*, Wiley 1986, cited over 10,000 times.

*: www.uakron.edu/rheology/

About the Speaker

Shi-Qing Wang entered Wuhan University in the spring of 1978. Through the CUSPEA program, he arrived in the US in fall 1982. After transferring to University of Chicago in 1983 he earned a doctoral degree in 1987, studying with a theoretical chemist (Karl Freed) on hydrodynamics of polymer solutions. After two years of postdoctoral study at UCLA, Shi-Qing Wang joined Case Western Reserve University as an assistant professor in Macromolecular Science. He was elected a fellow of APS in 1997 and became a full professor in 1998. In 2000 he moved to the current position. Since 2006, he visits China every year and holds guest professorship at Nanjing University, USTC, BUCT, Changchun Institute of Applied Chemistry where he has a collaborative project funded by the NNSF of China involving Lijia An at CIAC and Zhen-Gang Wang at Caltech.