CMET SEMINAR

Center for Molecular & Engineering Thermodynamics

Dr. Petekidis received his Bachelors degree in Physics from the Aristotle University of Thessaloniki in 1989 and moved to the Department of Physics of the University of Crete and FORTH in 1990 for graduate studies. He was awarded a Masters degree in Physics in 1995 and concluded his PhD thesis in Polymer Physics in 1997 working on the "Dynamics of Hairy-rod polymers". After serving his military service he moved to the Department of Physics and Astronomy of the University of Edinburgh with an individual Marie-Curie fellowship where he worked until 2002 under the supervision of Prof. P.N. Pusey on the "Dynamics of colloidal glasses under shear". In 2002 he joined FORTH initially with a return Marie-Curie fellowship and then (2004-2006) as an Associated researcher (grade C). In 2006 he moved to the Department of Materials Science and Technology of University of Crete where he is currently a Professor and affiliated faculty member of the Polymer Group of IESL-FORTH.

Role of Attractions in the Rheology and Internal Relaxations of Colloidal Glasses at Rest and Under Shear

I will present key microscopic mechanisms affecting the structure and particle dynamics when attractive interactions are added in a hard sphere glass. Furthermore the effect of attractions in the macroscopic response of repulsive (hard-sphere) and attractive glasses during nonlinear rheology and yielding is studied by a combined experimental and computer simulation study [1, 2]. I mainly focus on the way such systems yield under the application of steady or oscillatory shear via start-up shear tests and large amplitude oscillatory shear, as well as on the mechanisms of structural reformation and related stress relaxation after shear cessation. I discuss the phenomenology of two-step yielding, widely observed experimentally, its relation with quiescent microscopic dynamics and the underlying mechanisms affecting the relevant length- and time-scales during shear. Both experiments and Brownian Dynamics (BD) simulations show two peaks in stress versus strain during start-up shear tests with good qualitative agreement suggesting that Hydrodynamic Interactions are not crucially important at such highly concentrated systems. Structural analysis obtained from BD simulations confirms that the first yield is related to the breaking of the structure at the length scales smaller than attraction range while the second yield point is a consequence of cage deformation and breaking. I will finally compare the internal relaxation and the linear viscoelastic properties of attractive glasses under shear with those of repulsive glasses [3], by Orthogonal Superposition Rheometry where a small amplitude oscillation probes a sheared attractive glass in the ortogonal direction.

1. N. Koumakis, M. Laurati, S.U. Egelhaaf, J. F. Brady and G. Petekidis, Phys Rev. Lett. 108, 098303 (2012)
2. N. Koumakis, J. F. Brady and G. Petekidis Phys. Rev. Lett. 110, 178301 (2013)
3. A. R. Jacob, A. S. Poulos, S. Kim, J. Vermant and G. Petekidis Phys. Rev. Lett. 115, 218301, (2015)

George Petekidis

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Greece

DATE:

October 23, 2017

TIME:

2:00 p.m.

LOCATION:

366 Colburn Lab

UNIVERSITY OF DELAWARE

Department of Chemical & Biomolecular Engineering