NANOHOUR

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Beckman Institute - Room 2269

From molecules to colloids: the effect of particle size on phase behavior in nanoparticle systems

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Control of the phase behavior and properties of nanometer-sized particles is important for many applications from bioengineering to advanced composite materials. Modeling these systems is complicated by the fact that many nanoparticle systems are intermediate between molecular length scales, < 1.0 nm, and colloidal length scales, > 1 nm. Understanding the phase behavior of these intermediate systems requires a hybrid approach that incorporates concepts from both the colloidal and molecular fields of study. The interconnectivity of these two fields of study is demonstrated by showing how the properties of a generalized particle system change as the size of the particle continuously transitions from molecular to colloidal sizes. I will first show how this size-induced transformation can be physically realized in a molecular mixture of small and large particles.[1] I will then probe the mechanisms responsible for the size-induced glass transition of a generalized van der Waals molecule.[2] Finally, I will describe the effect of particle size on the existence of a stable liquid phase.[3] For a van der Waals colloid, a change in the absolute size corresponds to a change in the dimensionless length scale of the repulsions. I will show the effect of this length scale on the stability of the liquid phase and discuss implications for the control of phase behavior in several nanoparticle systems of practical interest.

[1] R. J. Larsen, C. F. Zukoski. *The molecular mixture as an effective single component system*, Journal of Physical Chemistry. B **115**, 3981 (2011).
[2] R. J. Larsen, C. F. Zukoski. *The effect of particle size on the glass transition*, Physical Review E, **83**, 051504 (2011).
[3] R. J. Larsen, C. F. Zukoski. *Effect of the range of repulsions on the stability of the liquid phase*, Journal of Chemical Physics, **136**, 054901 (2012).

Coffee and cookies will be served
http://nanohour.beckman.illinois.edu