



~~Special Polymer Physics Seminar ~~

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301 Steidle Bldg.

Nanoparticle Amphiphiles

It is easy to understand the self-assembly of particles having anisotropic shapes or interactions, such as Co nanoparticles or proteins, into highly extended structures. However, there is no experimentally established strategy for creating anisotropic structures from common spherical nanoparticles. We demonstrate that spherical nanoparticles uniformly grafted with macromolecules behave akin to “nanoparticle amphiphiles” because of the dislike between the inorganic and organic constituents.¹ These materials thus robustly self-assemble into a range of anisotropic superstructures under appropriate conditions of temperature and solvent quality. Theory and simulations both suggest that this self-assembly process reflects a balance between the energy gain when particle cores approach and the entropy of distorting the grafted polymers. The effectively directional nature of the particle interactions, which yields anisotropic assembly, is thus a many-body *emergent property*. Our experiments demonstrate that this approach to particle self-assembly allows for considerable control for the creation of polymer nanocomposites with enhanced mechanical properties. Both liquid-state and solid-state mechanical properties are examined and their molecular bases constructed.

[1] P. Akcora, H. Liu, S.K. Kumar et al, Nature Materials, 8, 354(2009)
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