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Nanoparticle Ionic Fluids

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Nanoparticle ionic materials (NIMS) are a new class of organic-inorganic hybrid materials comprised of a nanoparticle core functionalized with a covalently-attached organic corona. These materials manifest a remarkable transition to a "solvent-free" colloidal liquid state near room temperature. Physical properties of these nanoparticle ionic fluids can be manipulated over an unusually wide range by varying geometric and chemical characteristics of the inorganic core and organic corona. On one end of the spectrum are materials with a high core particle contents, which display properties similar to fragile glasses, stiff waxes, and gels. At the opposite extreme are systems that spontaneously form particle-based ionic fluids characterized by transport properties remarkably similar to simple molecular liquids, but with high dielectric constants, conductivities, and refractive index. This talk will introduce nanoparticle ionic fluids based on charged and uncharged corona species, explore their applications, and will discuss physical and mathematical models for understanding their interactions, complex relaxation dynamics, and rheology.