Nano-mechanics of ionic liquids at dielectric and metallic interfaces

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Using a dynamic surface force apparatus, we investigate the nano-mechanics and the nano-rheology of an ionic liquid at dielectric and metallic solid surfaces. On smooth dielectric Pyrex surfaces, we find an ordered interfacial phase extending over less than 3 nm away from the top of the layer, with a compression modulus of 15 MPa extracted from the profile of the oscillatory forces. We discuss the boundary flow of the Newtonian bulk phase on this ordered interfacial layer. On metallic platinum surfaces, our hydrodynamic measurements evidence an interfacial soft solid layer extending up to 20 nm away from the top of the layer. The elastic modulus of this interfacial layer, derived from elasto-hydrodynamic measurements, is similar to the one found on Pyrex surfaces. Both on the dielectric and on the metal surfaces, the thickness of the interfacial phases is not found to change upon approach of the opposite surface, and does not exhibit a capillary-freezing transition.