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Dipole interactions between dielectric spheres in AC electric fields MANISH MITTAL, ERIC FURST, University of Delaware — Rheological properties of Electrorheological (ER) suspensions change dramatically on application of electric field. One of the key issues in the study of ER fluids is the nature and strength of the forces between suspended particles. Micron-sized dielectric spheres aggregate to form linear chains on the application of an AC electric field. The dipole-dipole attraction is the dominant force in this process. The dipole moment has contributions from Maxwell-Wagner charge distribution and the double layer polarization. Using optical tweezers the force between a pair of polystyrene spheres has been measured by observing the displacement of particle held in a static optical trap, of known trap stiffness, from its equilibrium position. At a fixed salt concentration, frequency and electric field strength the radial and tangential force have been measured as a function of the center-to-center separation (r) and angle (θ) with the electric field to create a 2-dimensional force map. Such a complete 2-dimensional interaction profile of micron-sized particles has never been measured before. Subsequently the effect of field, frequency and background salt concentration was studied. It was found that adding salt and increasing field frequency suppressed dipolar interactions. This effect can be explained qualitatively by the double layer polarization theory. Finally the effect of particle geometry was studied by measuring interactions between particles of different size and shape.

Manish Mittal
University of Delaware

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