Modeling of Negative Electrorheological Flow Responses Induced by Internal Micro-particle Electrorotation

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Seminar Abstract

Electrorheological (ER) fluids are a class of fluids consisting of dielectric conducting or insulating solid micro-particles suspended within a dielectric viscous liquid medium. Electrorheology is the science and research field about controlling the macroscopic material properties, *e.g.*, effective viscosity, and the subsequent flow responses of ER fluids via means of externally applied electric field excitations. In this talk, we shall first introduce the phenomenon of micro-particle Quincke rotation, *i.e.*, the spontaneous electrorotation of micro-particles when subjected to a direct current electric field, found in particle-liquid systems in which the carrier liquid phase has a dielectric charge relaxation time much less than that of the suspended particles. We then discuss the theoretical modeling of negative ER responses, *e.g.*, reduced effective viscosities of ER fluids, induced by internal micro-particle Quincke rotation from a continuum electromechanical perspective. A close analogy between the present negative ER phenomena and the magnetorheological (MR) responses as found in current ferrohydrodynamics (FHD) literature will also be drawn and discussed.