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**Dynamics of electrorhoelogical(ER) fluids** JIANWEI ZHANG, Department of Physics, Hong Kong University of Science and Technology, Hong Kong, China, CHUN LIU, Department of Mathematics, Penn State University, University Park, PA, USA, PING SHENG, Department of Physics, Hong Kong University of Science and Technology, Hong Kong, China — Electrorhoelogical (ER) fluids are a class of colloids whose rheological characteristics can be controlled by applying an external electric field. Most applications of ER fluid are determined by its dynamic properties, reflecting the competition between the kinetic energy and internal energies. The relevant physics of dynamic processes is very different from that in static situations. We derive the fully coupled hydrodynamic system modeling the ER fluid dynamics using the energetic variational approach. The interaction between particles is treated as dipole-dipole in character, with a repulsive core. The solid particles and carrier fluid are treated as a two-component incompressible material. The induced electrical polarization and local fields are obtained self- consistently. The forces on the particles and the fluid are derived from the coupling between the transport of the particles and the induced stress. The total force on the moving boundary in stationary state is calculated via total dissipation inside the ER fluid.

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