Ferrofluids in time-varying magnetic fields: From ferrohydrodynamics to magnetic particle imaging

Author:
Dr. Carlos M. Rinaldi-Ramos

Affiliation:
Department of Chemical Engineering and J. Crayton Pruitt Family Department of Biomedical Engineering, University of Florida, Gainesville, FL 32611

E-Mail: carlos.rinaldi@ufl.edu

Abstract:
Magnetic nanoparticles respond to time varying magnetic fields via a combination of internal dipole and whole-particle rotation, depending on factors such as thermal motion, hydrodynamic drag, magnetic torques, and internal barriers to dipole rotation. Depending on the amplitude and frequency of the time varying magnetic field, the nanoparticle's response can give rise to conversion of magnetic field energy into heat or to a signal which can be used to monitor nanoparticle rotational diffusion or quantify nanoparticle distribution in a subject. This multitude of magnetic responses, coupled with their biocompatibility, makes iron oxide nanoparticles of great interest in sensing, biomedical imaging, drug delivery, and thermal therapy. In this talk I will provide an overview of my group's work advancing several of these applications, including monitoring nanoparticle mobility in complex and biological fluids, cancer thermal therapy, rewarming of cryopreserved organs, and non-invasive, unambiguous, and quantitative tracking of nanoparticles and cells using magnetic particle imaging.