

UCSD NANOENGINEERING/CHEMICAL ENGINEERING
Distinguished Seminar

Wednesday, October 26th, 2022

Seminar Presentation: 11:00pm - 12:00pm PDT

SME room 248

“Magnetic nanoparticle response to time varying magnetic fields – rotational diffusion measurements, hyperthermia, and magnetic particle imaging”

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Chair and Dean’s Leadership Professor in the Department of Chemical Engineering and Professor in the J. Crayton Pruitt Family Department of Biomedical Engineering at the University of Florida

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 alternating magnetic field, the nanoparticle’s response to the field 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 (e.g., magnetite and maghemite) of great interest in separations, sensing, biomedical imaging, drug delivery, and thermal therapy. In this talk I will provide an overview of the theory of magnetic nanoparticle response to time varying magnetic fields and my group’s work advancing several of these applications, including: (i.) monitoring nanoparticle stability and mobility in complex and biological fluids; (ii.) cancer thermal therapy; (iii.) rewarming of cryopreserved organs; and (iv.) non-invasive, unambiguous, and quantitative tracking of nanoparticles and cell therapies using magnetic particle imaging.

Keywords: Magnetic nanoparticles, nanoparticle diffusion, hyperthermia, rewarming, magnetic particle imaging

Biosketch: Carlos M. Rinaldi-Ramos is the Chair and Dean’s Leadership Professor in the Department of Chemical Engineering and Professor in the J. Crayton Pruitt Family Department of Biomedical Engineering at the University of Florida. He received his bachelor’s degree in Chemical Engineering at the University of Puerto Rico, Mayagüez, and completed degrees in Master of Science in Chemical Engineering, Master of Science in Chemical Engineering Practice, and Doctor of Philosophy in Chemical Engineering at the Massachusetts Institute of Technology. Prior to the University of Florida, Dr. Rinaldi-Ramos was a Professor in the Department of Chemical Engineering at the University of Puerto Rico, Mayagüez (UPRM). Dr. Rinaldi-Ramos’s research spans synthesis and characterization of magnetic nanoparticles for biomedical applications and evaluation of nanoparticle transport and diffusion in biological fluids. Current efforts focus on developing tracers and applications for magnetic particle imaging (MPI), an exciting new biomedical imaging modality that allows for non-invasive, unambiguous, and quantitative imaging of the in vivo distribution of superparamagnetic iron oxide nanoparticle tracers. Dr. Rinaldi-Ramos is also committed to mentoring new generations of scientists and engineers seeking solutions to biomedical problems and to broadening participation of women and minorities in science and engineering.