UNIVERSITY OF RHODE ISLAND
Department of Chemistry
SEMINAR

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“Characterization of particles in complex environments: nanomagnetism and more”

HOST
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Characterization of particles in complex environments: nanomagnetism and more

Abstract: Due to their magnetic properties and small sizes, magnetic nanoparticles can be used to mechanically actuate biological tissue and heat it up locally, using magnetic fields that are innocuous to humans. Magnetic nanoparticles move and rotate in the presence of an externally applied magnetic field. In that re-orientation, they can exert mechanical forces on the surrounding materials, or release energy in the form of heat. This mechanical and thermal actuation can be exploited to enhance drug dosage in the pathogenic cells (tumors or bacteria) by increasing drug diffusion in the surrounding tissue. In this talk, I will describe two projects that demonstrate that, by controlling the spatial arrangement of magnetic nanoparticles, their heating output can be tuned.

On the other hand, the same responsiveness of magnetic nanoparticles to magnetic fields makes them easy to detect and characterize at a distance using their magnetic response. Magnetic measurements can be used to quantify and characterize magnetic nanoparticles in complex media. An example will be described, in which magnetic characterization methods were used to determine the difference between two types of iron oxide particles derived from water purification technologies. When the method for magnetic nanoparticle detection is matured, it can be applied to quantify nanoparticles in other contexts, like in the workplace, human tissues or environmental particulate matter.

My research group looks at the two sides of the nanotechnology coin: nanotechnology’s beneficial applications, and its potential environmental and health implications.