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Multifunctional Ferromagnetic Particles

Dr. Valentine Novosad, Ph.D.
Senior Materials Scientist, Argonne National Laboratory

Argonne NATIONAL LABORATORY

Abstract: Nanoengineered magnetic materials are widely employed in fundamental studies and applied research. While the mainstream reports deal with chemically synthesized superparamagnetic particles on the order of tens of nanometers or their conjugates, an alternative approach based on the top-down physical methods commonly used in microelectronics is also of interest. Microfabricated particles can be designed to possess higher values of the magnetization of saturation while maintaining almost no net magnetization in the absence of a magnetic field due to the formation of non-uniform magnetization or antiferromagnetic ground states. Compared to wet chemistry synthesis, lithographic methods allow for precise, controlled fabrication of particles with virtually any size, shape, and composition. Physical vapor deposition, compatible with most types of photoresists, offers a wide choice of materials available. In this talk, we will discuss the fundamental mechanisms governing their magnetic properties and touch on some examples of employing such particles for MRI contrast enhancement, targeted drug delivery, hyperthermia, magneto-mechanical actuation, and ultrasensitive detection.

Biography: After earning his MS (with Honors) in aerospace engineering from Kharkiv Aviation Institute, Ukraine, he joined a Ph.D. program at the Verkin Institute for Low Temperature Physics & Engineering, National Academy of Sciences of Ukraine. During his Ph.D., Valentine worked on diffraction magneto-optical Kerr effects for 18 months at the Laboratoire de Magnétisme Louis Néel, CNRS, Grenoble, France. He then completed postdoctoral training at the Department of Materials Science, Graduate School of Engineering, Tohoku University, Sendai, Japan, where he studied geometric confinement effects in nanomagnets. Next, Dr. Novosad joined the US Department of Energy's Argonne National Laboratory, where he is currently employed as a Senior Materials Scientist in the Superconductivity and Magnetism Group, Materials Science Division.

Dr Novosad is an elected Fellow of the American Physical Society and a recipient of the University of Chicago's Distinguished Performance Award and Medal. His research interests span from fundamental studies of magnetic and superconducting films and patterned heterostructures to their practical applications, such as in spintronics, nanomedicine, cosmology, and nuclear physics.

Google Scholar profile: https://scholar.google.com/citations?user=OvqMO6MAAAAJ&hl=en
Email: novosad@anl.gov