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Temperature Dependence of Magnetic Nanoparticles for Metamaterials[1] QUINCY WILLIAMS, NATALIA NOGINOVA, Norfolk State University, PAGNAGIOTIS DALLAS, EMMANUEL GIANNELIS, Cornell University, NORFOLK STATE UNIVERSITY COLLABORATION, CORNELL UNIVERSITY COLLABORATION — Commonly, metamaterials are systems with engineered electric response, based on optimized spatial arrangement of sub-wavelength sized metal and dielectric components. We explore alternative methods based on use of magnetic inclusions, such as magnetic nanoparticles, which can allow microwave permeability of a composite to be tuned from negative to positive at the range of magnetic resonance. Several systems with magnetic nanoparticles of different size were experimentally tested for estimate their potential as building blocks for metamaterials. Magnetic resonance studies were performed in the limits of diluted non-interacting solutions of superparamagnetic nanoparticles in liquid form and high concentrations of particles in solids at different temperatures. Broadening of the EMR signal was observed upon increase in the particle size and concentration, due to effects of anisotropy and dipolar interaction. Microwave permeability was estimated in solid composites. In dense systems with 5 nm iron oxide nanoparticles it can be tuned from –0.8 to 2 by the external magnetic field.

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