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Core/Shell and High Aspect Ratio Magnetic Oxide Nanoparticles for Antenna Applications THOMAS F. EKIERT, JR., Air Force Research Lab - WPAFB, Universal Technology Corporation, MATTHEW O'MALLEY, Air Force Research Lab - WPAFB, BRANDON YOCUM, JENNIFER LIPPOLD, MALLORY LYLE, ANGELA GRINER, CORY FLYNN, ANNA NICKEL, Air Force Research Lab - WPAFB, Southwestern Ohio Council for Higher Education, MAX D. ALEXANDER, JR., Air Force Research Lab - WPAFB — Improved antenna gain, reduced antenna aperture size, and improved bandwidth are of interest to an increasingly mobile world. To obtain these improvements our efforts are directed at developing new magnetic oxide nanoparticle/polymer composites with modifiable permeability and permittivity and low electrical losses. Our approach consists of producing core/shell and shape controlled magnetic nanoparticles. Methods of synthesis utilize microwave and traditional heating to perform hydrothermal and solvothermal reactions. Decomposition of metal acetylacetonates is performed using various alcohols resulting in spherical nanoparticles with diameters of ≈8-16 nm and 3-7 nm for Fe_3O_4 and $CoFe_2O_4$, respectively. Microwave methods result in similar particles, but are produced in an hour or less as compared to 48 hrs via the traditional solvothermal method. Successive growths are used to produce larger monolithic particles as well as core/shell systems where exchange coupling between the core and shell is observed. Hexaferrite particles have been produced via hydrothermal synthesis, while high aspect ratio Fe_3O_4 nanoparticles (≈10-100 nm) produced via hydrothermal synthesis result in nanoneedles with high μ_r.

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