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NMR Study of ε-Co Nanoparticles[1] DAVID PERRY, JOSEPH BUDNICK, WILLIAM HINES, Department of Physics, University of Connecticut, Storrs, CT 06269-3046, MADHUR SACHAN, SARA MAJETICH, Physics Department, Carnegie Mellon University, Pittsburgh, PA 15213 — ^{59}Co spin-echo nuclear magnetic resonance (NMR) spectra were obtained at 4.2 K and 1.3 K for a 6.5 nm ε-Co nanoparticle system. The powder sample was synthesized using an air-free high boiling point solution procedure and sealed in glass ampules without exposure to air. No NMR signal is observed at either 4.2 K or 1.3 K over the frequency range 150 MHz <= ν <= 250 MHz for H = 0; however, the application of a magnetic field 1.5 kOe <= H <= 7.5 kOe results in the appearance of a very strong echo. The NMR spectra are characterized by two components: (1) a distinct peak at 232 MHz whose intensity increases but does not shift with increasing field and (2) a very broad distribution between 150 MHz and 210 MHz whose intensity both increases and shifts to higher frequency with increasing field. There is no trace of the peaks which characterize either the multidomain or single domain fcc or hcp phases. Furthermore, a dramatic time evolution of the echo (observed at both 205 MHz and 232 MHz) is observed when the field is suddenly increased or decreased. An attempt to understand the spectra in the light of a core-shell picture for the ε-Co nanoparticles, superparamagnetism, and the interparticle and intraparticle interactions is made.

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