Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Magnetic Properties of As-Prepared and Annealed Nanocrystalline Fe Particles KARL UNRUH, THOMAS EKIERT, University of Delaware — Air stable Fe-core/oxide-shell particles with diameters between about 100 and 200 nm have been synthesized by the reduction of a ferrous Fe salt in the presence of citrate ions. Structural, chemical, and magnetic measurements indicate that the oxide shell is 2-3 nm thick and that the core consists of essentially oxide free, α-Fe nanocrystals (about 5 nm in diameter) in addition to regions of non-crystalline, disordered Fe. The as-prepared particles evolve into a continuous porous solid structured at about the 100 nm scale after annealing in forming gas at temperatures near 750 K followed by a progressive elimination of the porosity at higher annealing temperatures. Prior to the formation of the porous solid the saturation magnetization, coercivity, and remanence ratio all increase slightly with annealing temperature due to an increase in the size of the core Fe crystallites at the expense of the disordered Fe component. The structural transformation to a porous solid, however, results in an abrupt increase in both the coercivity (by about 50% at 300 K and 100 % at 5 K) and remanence ratio (about 100% at 300 K and 150% at 5 K).

Karl Unruh
University of Delaware

Date submitted: 21 Nov 2008 Electronic form version 1.4