Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Solid-State Homogenization Reactions in Cu Core/Ni shell Nanoparticles MICHAEL LATTANZI, LAURA HIGGINS, BRIAN KELLY, University of Delaware, GERALD POIRIER, Princeton University, KARL UNRUH, University of Delaware — Air stable Cu core/Ni shell nanoparticles have been prepared in a polyol-type process by heating an ethylene glycol (EG) solution containing $CuCl_2 \cdot 2H_2O$ and $NiCl_2 \cdot 6H_2O$ to its boiling temperature, adding an appropriate amount of NaOH, and allowing the reaction to proceed at reflux for 30 minutes prior to cooling. The as-prepared nanoparticles were characterized by scanning electron microscopy (SEM) with elemental mapping, x-ray diffraction (XRD), and vibrating sample magnetometry (VSM) measurements. Chemical composition maps of the particles revealed a well-defined core/shell structure consisting of a Cu core about 100-150 nm in diameter surrounded by a Ni shell about 30-40 nm in thickness. XRD measurements indicated that while the Cu core contained a small amount of incorporated Ni, the shell was essentially pure Ni. The solid-state transformation from the as-prepared core/shell structure to an essentially homogeneous Cu-Ni alloy was studied by high temperature VSM and XRD measurements as a function of annealing temperature and time. These measurements reveal that the core/shell structure remains largely intact to temperatures above 400 $^\circ$C and that complete homogenization occurs at temperatures above about 600 $^\circ$C.

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Date submitted: 19 Nov 2010 Electronic form version 1.4