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Solid-State Diffusional Mixing in Cu Core/Ni Shell Nanoparticles KARL UNRUH, BRIAN KELLY, JOHN KLODNICKI, University of Delaware, GERALD POIRIER, Princeton University — Cu core/Ni shell nanoparticles have been prepared in a polyol process using ethylene glycol as the solvent /reducing agent solution and Cu and Ni acetates as the metal sources. The more positive reduction potential of Cu(II) relative to Ni(II) lead to the formation of Cu core/Ni shell nanoparticles. The structural evolution of these core/shell diffusion couples was studied by high temperature x-ray diffraction measurements. Between room temperature and 350 °C, the evolution in the diffraction pattern was only due to lattice expansion. At higher temperatures, the elemental Cu and Ni diffraction peaks began to merge until, at a temperature of 600 °C only a single set of diffraction peaks remained, indicating the formation of a single homogeneous Cu-Ni alloy. These diffraction patterns have been decomposed into a set of 11 individual subpeaks corresponding to 9 intermediate Cu-Ni compositions in addition to subpeaks corresponding to pure Cu and Ni. The angular positions of each subpeak were fixed to the values appropriate for their composition and the best fit peak areas determined. These data were then used to reconstruct the radial composition profiles of the diffusion couples as a function of the reaction temperature and time.

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