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Atomic structure of high-coercivity cobalt-carbide nanoparticles ensembles D.A. ARENA, G. STERBINSKY, NSLS / BNL, P.W. STEPHENS, Physics Dept, SUNY-Stonybrook, K.J. CARROLL, H. YOON, S. MENG, Dept. NanoEngineering, UC San Diego, Z. HUBA, E.E. CARPENTER, Chemistry Dept, Virginia Commonwealth Univ. — Permanent magnets are increasingly important in numerous applications, including the quickly expanding area of green technologies (*e.g.* high efficiency electric car motors and wind turbine power systems). We present studies of novel permanent magnet materials based on cobalt carbide nanoparticles (NPs), where the energy product (BH_{max}) exceeds 20 kJ / m^3 [1]. The NPs are synthesized via a polyol process, which offers a flexible approach to modify the Co-carbide phase (Co_2C and Co_3C), and NP morphology, size and size dispersion. The Co_2C and Co_3C phases have unique magnetic properties, and the combination exhibits the high BH_{max}. We present a detailed assessment of the structure of mixtures of Co_2C and Co_3 NPs, measured by high-resolution, synchrotron based powder x-ray diffraction (p-XRD). Both the Co_2C and Co_3 phases exhibit an orthorhombic structure (Pnnm and Pnma space groups, respectively). The high-resolution p-XRD facilitates identification of mixed phase samples, enabling detailed comparisons of the atomic structure with the magnetic properties, measured by both lab-based magnetometry and x-ray spectroscopy (soft x-ray XAS & XMCD).
[1] V. G. Harris et al., J. Phys. D: Appl. Phys. 43, 165003 (2010).

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