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Magnetic and electronic structure of high-coercivity cobalt-carbide nanoparticles for permanent magnet applications GEORGE STERBINSKY, National Synchrotron Light Source, Brookhaven National Laboratory, KYLER CARROLL, HYOJUNG YOON, SHIRLEY MENG, Department of NanoEngineering, University of California San Diego, ZACHARY HUBA, EVERETT CARPENTER, Department of Chemistry, Virginia Commonwealth University, DARIO ARENA, National Synchrotron Light Source, Brookhaven National Laboratory — Permanent magnets are important in numerous technological applications. However, those with the largest energy product (BH_{max}) contain rare earth elements, which increase costs and introduce volatility into the supply chain. Recently, rare-earth free Co_2C and Co_3C nanoparticles (NPs) with large magnetic coercivity and BH_{max} have been synthesized using a polyol process [1]. Optimal $BH_{max}$is found in a mixture of the two phases. In this system, the nature of the magnetic interparticle interactions and the origins of intrinsic magnetic properties of the Co-carbide phases are not fully understood. We have investigated the origins of the magnetic properties of Co_2C and Co_3C NPs using x-ray absorption spectroscopy (XAS) and x-ray magnetic circular dichroism (XMCD) measurements at the Co L-edge and C K-edge. From differences in the electronic structures of the two Co-carbide phases, as determined by XAS, the nature of their unique magnetic properties can be deduced. Furthermore, the role of the spin and orbital moments in determining magnetic anisotropy and BH_{max} in these materials is examined with XMCD. [1] V. G. Harris et al. J. Phys. D: Appl. Phys. **43**, 165003 (2010).

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