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Spin and orbital moments of Co-carbide nanoparticles for permanent magnet applications D.A. ARENA, G.E. STERBINSKY, Photon Sciences Directorate, Brookhaven Nat. Lab, K.J. CARROLL, H. YOON, S. MENG, Nanoengineering Dept., U.C. San Diego , Z.J. HUBA, E.E. CARPENTER, Chemistry Dept., Virginia Commonwealth Univ. — Many efforts are currently devoted to the development of rare earth free permanent magnets (REFPMs). In newly developed permanent magnet materials, examination of the atomic scale magnetic properties is critical to gaining knowledge of the mechanisms of magnetism and hence furthering the development of these materials. X-ray magnetic circular dichroism (XMCD) is a core-level technique ideally suited for such studies as it provides element-specific information on magnetic properties. We present an XMCD study of the REFPM nanoparticulate Co-carbide using a new high-field end-station at beamline U4B of the National Synchrotron Light Source. This end-station facilitates measurement of XMCD spectra from magnetically hard materials. The Co-Carbide nanoparticles (NPs) under study are synthesized via wet chemical methods, which can lead to differences between the atomic and magnetic structures of the surface and bulk of NPs. To separate the determination of the surface and bulk magnetic properties we have combined our XMCD measurements with in-situ surface treatment. Preliminary measurements of Co L-edge XMCD spectra and element specific hysteresis point to the role of the Co orbital and spin moments in the establishment of the high coercive field and $(BH)_{max}$ in Co-carbide NPs.

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