Neutron diffraction studies of exchange-biased Co/CoO core-shell nanoparticles

SUE INDERHEES, GLENN STRYCKER, MEIGAN ARONSON, University of Michigan, YIMING QIU, JULIE BORCHERS, NIST, YADONG YIN, Lawrence Berkeley National Lab — We present neutron diffraction data on exchange-biased Co/CoO core-shell nanoparticles. Surfactant-coated Co particles were prepared by thermal decomposition of Co$_2$(CO)$_8$, then oxidized to form core/shell particles with a poly-crytalline CoO shell. Magnetization data display strong exchange bias below the 200K blocking temperature ($T_B$), well below the Neel temperature of bulk CoO (293 K). Neutron diffraction data show a broad peak at the ($\frac{1}{2} \frac{1}{2} \frac{1}{2}$) antiferromagnetic CoO ordering wave vector. The anti-ferromagnetic order parameter is constant below $T_B$, and decreases with increasing temperature above $T_B$. These results demonstrate that the diminished $T_B$ in small core/shell particles is not due to a reduction of $T_N$ of the antiferromagnetic shell.