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Tuning the Magnetic Properties in Exchange Coupled FeO/Fe_3O_4 Core-Shell Nanoparticles NATALIE FREY HULS, NIST, XIAOLIAN SUN, SHOUHENG SUN, Brown University, NIST COLLABORATION, BROWN UNIVERSITY COLLABORATION — Chemically synthesized FeO with a native oxide shell has recently received attention due to the large exchange bias effects observed in this system. The magnetic properties reported thus far have been highly dependent upon the aging affects of the system given the vulnerability of FeO to further oxidation resulting in degradation of the exchange bias effects. We report on the magnetic properties of FeO nanoparticles chemically synthesized to form several base diameters (10 nm, 20 nm, and 30 nm) which have each been annealed at various temperatures to obtain a variety of core/shell FeO/Fe_3O_4 size ratios. This controlled oxidation method has also given excellent chemical stability to the particles. XRD analysis confirms the existence of polycrystalline phases of FeO and Fe_3O_4, and magnetometry experiments reveal the existence of large exchange bias (up to 230 mT) as well as coercivity enhancements (up of 250 mT) which persist up the Néel temperature (which scales with core size). Other exchange coupling effects such as a large vertical shift in the field cooled hysteresis loops and asymmetric magnetization reversal are observed. Our results further advance the understanding of this exchange coupled system and imply that the properties can be chosen utilizing as-synthesized particle size and annealing temperatures.

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