MS40-P01 | STRUCTURAL CHARACTERIZATION OF EXCHANGE BIASED AU-Fe_3O_4 DUMBBELL NANOPARTICLES

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We have studied the origin of the exchange bias effect in the Au-Fe_3O_4 dumbbell nanoparticles in two samples with different sizes of the Au seed nanoparticles (4.1 and 2.7 nm) and same size of Fe_3O_4 nanoparticles (9.8 nm). The synchrotron x-ray pair-distribution function measurements, small-angle x-ray/neutron-scattering and scanning transmission electron microscope measurements determined the antiferromagnetic FeO wüstite phase within Fe_3O_4 nanoparticles, originating at the interface with the Au nanoparticles. The interface between antiferromagnetic FeO and ferrimagnetic Fe_3O_4 is giving rise to the exchange bias effect. The strength of the exchange bias fields depends on the interfacial area and lattice mismatch between both phases. We propose that the charge transfer from the Au nanoparticles is responsible for a partial reduction of the Fe_3O_4 into the FeO phase at the interface with Au nanoparticles. The Au-O bonds are formed, presumably across the interface to accommodate an excess of oxygen released during the reduction of magnetite.