[MS27 - 05] Total Scattering Structure-Microstructure Study of Fe_3O_4/γ-Fe_2O_3 Nanoparticles. A. Cervellino[a], R. Frison[b], G. Cernuto[c], N. Masciocchi[c], G.M. Colonna[d], A. Guagliardi[b,c]

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Magnetic iron oxide (Fe_3O_4/γ-Fe_2O_3, magnetite–maghemite) nanoparticles (NPs) are widely studied because of their importance in many different fields like information technology (ferrofluids, data storage),
neurobiology (migratory birds [1]), medicine (drug delivery, medical imaging) and chemistry (catalysis) [2]. However, a detailed understanding of some of their structural and micro-structural aspects – especially at the nanoscale - is still missing [3,4]. The magnetic
properties of these nanoparticles are governed by fine structural details (lattice parameter, iron oxidation state and site occupancy and related vacancy ordering). These in turn depend also on particle size, shape and surface state. This complexity explains how currently proposed
structural models are not yet exhaustive [5]. We performed a detailed structural characterisation of several Fe_3O_4/γ-Fe_2O_3 NP samples synthesised by direct co-precipitation of iron salts (Fe^{2+} and Fe^{3+} in the correct ratio for preparing magnetite) in an aqueous medium. The iron salts concentration and the postsynthesis annealing/ oxidation temperature and duration were tuned in a broad range. X-ray powder diffraction data were acquired at the MS-Powder X04SA beamline of the SLS synchrotron at PSI, Villigen, CH. The diffraction data were analysed, for the first time, by the Debye Equation reciprocal space Total Scattering method [6,7]. As a result, the size distribution of each NP sample was obtained.
as size dependent quantities. A stringent law relating the lattice parameter to both particle size and NP stoichiometry and oxidation state was obtained. Details of the structural and microstructural modeling will be shown
and quantitative results accounting for oxidation and surface effects presented. These results will be correlated to separately measured magnetization curves for these samples. Study supported by Cariplo Foundation, Project 2009-2446.

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