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**MS-12-O-1524 Characterization of synthetic Fe-oxide nanoparticles: microstructure and magnetic properties**

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Magnetite nanoparticles (NPs) are attracting a lot of attention due to their potential applications that range from data storage to biomedical applications such as hyperthermia. The main challenge in the field of magnetite NPs is controlling their structure, size and stoichiometry, parameters that ultimately determine their magnetic properties.

The different behaviour of the magnetic properties of Magnetite Nanoparticles has previously been associated to differences in sample size distributions and/or the deviation from stoichiometric bulk Fe<sub>3</sub>O<sub>4</sub>.

In this work we study NPs synthesized using three different methods based on high temperature decomposition followed by organic surfactant coating, [1-3] NPs synthesis methods.

Magnetic measurements of the three samples show quite different magnetic behaviours despite being monodispersed samples. All three methods produce NPs and based on selected area electron diffraction and x-ray diffraction, all produce magnetite with the possibility of a small maghemite fraction. Despite this, the measured magnetic properties are quite different.

Magnetization curves at 10 K and 5 T field gives magnetization values of  $81 \pm 12$  emu/g for Sun method particles  $12.3 \pm 2.9$  nm in diameter and drastically lower values for Hyeon and Calvin method,  $39 \pm 4$  emu/g and  $37 \pm 1$  emu/g, respectively. High resolution scanning transmission electron microscopy shows that the Colvin method particles have significant amount of stacking faults such as antiphase domain boundaries and twinning defects. These defects when present in thin films magnetite [4], can change the relative proportion of ferromagnetic and antiferromagnetic interactions, which consequently modify their magnetic properties, mainly due to the increase of antiferromagnetic interactions across the defects. The presence of similar type of defects in NPs can also potentially modify strongly their magnetic properties, and it is a possible reason for the huge variation of their magnetic properties that depend strongly of the preparation method.

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