SURFACES AND GRAIN BOUNDARIES IN MAGNETIC NANOSTRUCTURES

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The magnetic properties of nanostructures strongly differ from those of microstructures because of the enhanced role of surfaces, grain boundaries or interfaces, according to their dimensionality. They originate fundamental problems which have to be clarified and well controlled in order to make suitable these magnetic nanostructures. We first review the main structural characteristics and relevant parameters in correlation with the chemistry and stability of these systems, and expected static and dynamic magnetic properties induced by the confinement effects.

Then, we report experimental studies on several illustrative examples from oxide nanoparticles (maghemite, magnetite and ferrites, in the as-prepared, subsequently annealed and functionalized states) and then metallic and ionic nanostructured powders. Special attention is focused on both the experimental determination and computer modelling of the structure of surface or grain boundaries. In addition to diffraction techniques and microscopies, local probe spectroscopies are effective tools to identify atomic species located at surface and grain boundaries. The role of both zero-field and in-field ^{57}Fe Mössbauer spectrometry is emphasized in the case of Fe based nanostructures in conjuntion with static and ac magnetic measurements, to better understand local scale and time scale structural and magnetic properties. These features are well supported by computer modelling of surface and grain boundaries effects.

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