Magnetic properties of nanostructures

J.M. Greneche

Institut des Molécules et Matériaux du Mans, UMR CNRS 6283, Le Mans Université
72085 Le Mans Cedex, France
jean-marc.greneche@univ-lemans.fr

Over the past three decades, much attention has been paid to the development of nanoarchitectures, particularly their elaboration, using either direct chemical synthesis routes or/and post-treatments using different processes. Although the chemical nature of surfaces of nanoparticles must be well correlated to physical properties, the role of interfaces in nanoarchitectures needs to be better understood. Indeed, many new synthesis routes have been developed to prepare well-defined magnetic nanoparticles while the role of the different chemical parameters has been studied in depth resulting in their high reproducibility: their size, morphology, chemical composition, structural and physical properties can now be well controlled and tuned. The following strategy consists in manipulating these nanoparticles using temperature, pressure, mechanical stimuli to design new architectures dealing with new physical properties.

The main strategy to characterize these magnetic nanoarchitectures is based on the combination of diffraction techniques, microscopies, magnetic measurements and local probe techniques to get a detailed insight at different scales. The goal is to correlate magnetic characteristics (saturation magnetization, coercive field, exchange bias, dipolar interactions) to local atomic structures including that of interfaces and/or grain boundaries. We therefore report some recent examples of studies, illustrating in particular how such effects can be identified and modelled to understand experimental data.