

Advanced characterization techniques for magnetic nanoparticle investigation

Magnetic nanoparticles are gaining increasing interest due to numerous applications in advanced fields such as permanent magnets, magnetic recording media, microwave adsorption, ferrofluids and biomedicine. During the last 20 years, new developments in synthesis and assembling techniques opened huge perspectives toward the design of complex structures of nanoparticles as well as the preparation of arrays with more or less ordering. The topic is of great complexity, essentially because the magnetic properties of the nanoparticles depend on various critical parameters such as object's size, shape, crystallographic, chemical composition and electronic structure, but also on the local medium to which the nanoscale objects belong. The combination of a large panel of advanced techniques represents a unique experimental approach capable to reveal correlated information on the crystal structure, chemical composition, electronic and magnetic properties of nanoparticles which can be considered as single object, random assemblies or ordered arrays.

Magnetic nanoparticles will be first introduced in order to depict the challenges related to their integration in technological devices. The context and the state of the art of each characterization technique will be presented. Selected examples will illustrate their interest to bring information on the structural, chemical and magnetic properties of nanoparticles. The school encompasses the following topics (1h30 minutes each):

Introduction to magnetic nanoparticles

B. Pichon and S. Begin (IPCMS)

Transmission electronic microscopy and holography

C. Ulhaq and V. Pierron-Bohnes (IPCMS)

Nanoparticle characterization through X ray diffraction

C. Lefèvre (Institut de Physique et Chimie des Matériaux de Strasbourg)

Femtomagnetism and nanostructures

V. Halte (Institut de Physique et Chimie des Matériaux de Strasbourg)

⁵⁷Fe Mössbauer spectrometry applied to magnetic nanoarchitectures

J.-M. Grenèche (Institut des Molécules et des Matériaux du Mans)

Probing magnetic nanoparticles by soft X-ray Magnetic Circular Dichroism

F. Choueikani (Synchrotron SOLEIL, Saclay)

Neutron scattering on magnetic nanostructures

F. Ott & G. Chaboussant (Laboratoire Leon Brillouin, Saclay)

Magnetic Properties of Single Nanoparticles by Scanning Probe Techniques

M. Rastei (Institut de Physique et Chimie des Matériaux de Strasbourg).

Time : 26th and 27th of April 2017. The school start at 9:00 on the 26th April.

Place: Auditorium, Institut de Physique et Chimie des Matériaux de Strasbourg, 23 rue du Loess, 67034 Strasbourg.

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