

## Condensed Matter

The aim of this group is the experimental and theoretical study of materials with complex phase diagrams (as a consequence of their close interrelationship between structural, magnetic and electronic properties), whose physical or chemical behavior have an academic and/or technological interest.

Among the main theoretical subjects it can be mentioned:

- Molecular dynamics simulations in sulfur, water, fullerenes, nanotubes and in organic bilayers, crystals and liquids, hard coatings - Surface diffusion in semiconductors.
- Statistical mechanics: Fluids (integral equations, density functional and application to lattice gases) - Complex systems (econophysics, game theory, S.O.C., etc) - Phases with modulated disorder.
- Calculations of magnetic and electronic properties (transport of layered and granular systems), low dimensional magnetism (1- and 2D) - Non-collinear magnetism - Magnetic anisotropy in thin films – Magnetism and electronic properties of nanosystems - Relationship between magnetism and superconductivity.
- Simulation of protein structure.

And among the main experimental subjects:

- Low field magnetoresistance and phase separation in manganese based oxides.
- Structural studies on molecules with biological interest (small molecules and proteins).
- Magnetic structural properties of Fe- based compounds: oxides, hydroxides, intermetallics. Applications of Mossbauer spectroscopy to the study of nanomagnetism, changes on magnetoproperties of oxides, soils, corrosion problems.
- Synthesis, characterization and studies on the thermal behavior and stability of inorganic compounds (perovskites, manganites, high T<sub>c</sub> superconductors and its precursors) and carboxylate complexes of lanthanides and transition metals. Synthesis of nanostructured materials (nanotubes of colossal magnetoresistent compounds, nanowires and nano powders)
- Effects of controlled defect introduction (by chemical substitution and irradiation) on transport properties.
- Polymorphism and stability problems on pharmacological drugs and polymers.
- Environmental problems: retention of toxic metal traces onto inorganic and biological substrates (water remediation), analysis of atmospheric particles.
- Biological related problems (biomineralization, radiation probes).
- Raman Spectroscopy of hard carbon and silicon-carbon coatings.