Soft Magnetic nanostructures investigated by ^{57}Fe Mössbauer spectrometry

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During the last three decades, many soft magnetic nanostructures have been developed: their morphology remains a crucial point to understand the origin of their magnetic properties. The study of their structural and magnetic properties requires the complementarity of several techniques. In addition to conventional ones, ^{57}Fe Mössbauer spectrometry is an excellent tool, as this local probe technique must first discriminate surface and volume effects, grain boundaries and interfaces, in addition to oxidation states and spin Fe species, and then help to follow the hyperfine magnetic properties and their dynamics in correlation with superparamagnetic relaxation phenomena.

After reviewing the main structural and magnetic characteristics of different types of nanostructures, we illustrate from selected examples how the selectivity and local probe character of ^{57}Fe Mössbauer spectrometry contribute to investigate *in situ* local atomic order and magnetic properties. In addition, we report some numerical modeling results, showing how Mössbauer spectrometry and Monte Carlo and / or *ab initio* calculations are complementary approaches.