The development of techniques for the characterization of magnetic nanomaterials has great interest by reason of the specific properties that occur in magnetic materials when their dimensions are reduced to the nanoscale. These properties, coupled with the nanometric size, make magnetic nanomaterials suitable for several biomedical applications. Magnetic nanoparticles (MNPs) can be used as carriers for drug delivery systems, mediators for magnetic hyperthermia treatments, contrast agents for Magnetic Resonance Imaging (MRI), markers for cell labeling [1].

The design of these techniques requires a detailed knowledge on the magnetic and structural properties of the adopted nanomaterials. For example the magnetic hyperthermia heating effect, the translational force exerted on drug delivery carriers, the drag force in cells magnetic separation systems are strongly dependent on the size and the magnetic properties of the nanoparticles, like the magnetic susceptibility $\chi$, the saturation magnetization $M_s$, and the magnetic dipole $m$.

Standard techniques, like Superconducting Quantum Interference Devices (SQUID) or Vibrating Sample Magnetometer (VSM), allow the detection of global magnetic properties of nanoparticles populations. But the detection of magnetic properties of single particles is not possible and the evaluation of these properties in dependence of the particles size is not explicit.

In this work we develop an experimental procedure to obtain quantitative measurements of nanoparticles magnetic properties ($\chi$, $M_s$, $m$) and to directly relate these characteristics with the particles size, by using Magnetic Force Microscopy (MFM). MFM is a particular non-contact scanning probe technique, based on the detection of the magnetostatic interaction between a magnetic AFM probe and a magnetic sample [2]. Thanks to its nanometric lateral resolution and its capability to detect weak magnetic fields, MFM is a powerful tool for the characterization of single nanoparticles dimensions and magnetic properties. However, MFM measurements are also affected by non magnetic tip-sample interactions. Consequently the quantitative magnetic characterization of nanomaterials requires the accurate analysis and interpretation of MFM data. In this respect, the study is also focused on the evaluation of the influence, on the MFM measurements, of non-magnetic tip-sample interactions, like electrostatic forces, with the aim of assessing an experimental procedure to detect only magnetic tip-sample interactions.

Overall, this work represents a preliminary study on the applicability of MFM technique in the quantitative measurement of properties of magnetic nanomaterials.