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Consiglio Nazionale delle Ricerche

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Investigation of structure and magnetism of magnetic nanoparticles and thin films using neutron and synchrotron (soft and hard) radiation

Abstract

Magnetic thin films and nanoparticles are at the forefront of research in nanoscience. They have proved their potentials in the field of nanoelectronics, spintronics, energy, catalysis, bio-medicine and many more and continue to show a lot of promise for future novel applications. Therefore, it is necessary to develop advanced, cost effective and scalable synthesis processes as well as modern characterization tools to understand and tune the synthesis process for desired application. Today, synchrotron and neutron radiations play an important role during characterization process as they are routinely used for structural and magnetic characterization. I will explore various aspects of use of synchrotron and neutron radiation for characterization of self-assembled iron oxide nanoparticles from atomic to mesoscopic scale. Techniques such as GIXRD, GISAXS and XRR combined with electron microscopy and SQUID magnetometry will be discussed in order to understand correlation between the structural and magnetic properties of the self-assembled systems. Moreover, the appearance of “soft Superferromagnetism”, due to strong magnetic dipolar interaction will be explored by polarized neutron reflectivity (PNR). Next, soft x-ray magnetic scattering from out-of-plane magnetized Co/Pd multilayers will be discussed. Particularly, disentangling weak, in-plane closure domain scattering from strong, primary domain scattering will be addressed. Finally, development of coherent x-ray scattering and imaging (soft x-ray Holography) using CXS chamber at Bessy II will be presented.