3D magnetometry in nanomaterials using XMCD-PEEM microscopy

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One of the main trends in the magnetism roadmap is the study of the magnetic configuration and magnetization dynamics of magnetic nanoelements. Size reduction means new magnetic phenomena linked to the nanoscale. Different microscopy techniques like magnetic force microscopy can be used to explore the magnetic configuration of these nanoobjects. However, these techniques normally do not provide us with information about the 3D configuration of the magnetic moments, which could be crucial in many cases. In this work we combine the use of XMCD-PEEM and micromagnetic simulation to obtain 3D information of the magnetic configuration of in-situ grown single crystal nanometer-thick magnetite islands [1] and of magnetic nanowires [2].

The experiments have been performed at the CIRCE beamline of the Alba synchrotron. This beamline is equipped with a photoemission microscope in which, by taking XMCD images, is possible to acquire nanometer resolution maps of the magnetization of nanosystems. Combining measurements at different azimuthal angles, the full magnetization vector can be determined (figure 1). Combining the experimental magnetization maps with micromagnetic simulations, the magnetic configuration of the systems can be completely determined. We will show how the combination of XMCD-PEEM with imaging and data analysis is a very powerful tool for the study of magnetic configurations of nanometer sized objects.

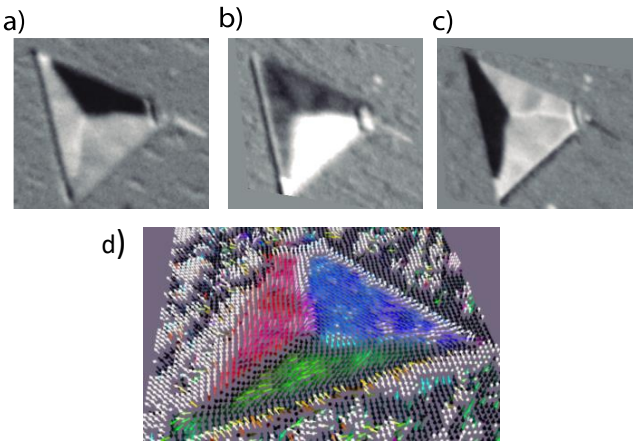

Figure 1. XMCD-PEEM images collected after rotating the sample 0 (a), 60 (b) and 120 (c) degrees. (d) 3D magnetic configuration.

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References

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