HARD X-RAY MAGNETIC CIRCULAR DICHROISM: APPLICATION TO SPINTRONICS MATERIALS

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Recent developments in the synchrotron radiation instrumentation have made possible the production of high flux of hard X-ray photons (2 - 15 keV) with flexible polarization [1]. Magnetic circular dichroism (MCD), the difference in the absorption or reflection of magnetic samples using left- and right-handed circularly polarized light has been widely exploited in the visible and soft X-ray spectral regions to provide useful information on the electronic and magnetic properties of magnetically ordered systems [2].

This talk reviews the recent advances in magnetic circular dichroism experiments in the hard X-ray energy range which covers K-edges of transition metals, L-edges of rare-earths, L-edges of 4d and 5d metals and M-edges of actinides. After giving a short introduction to the principles of X-ray MCD spectroscopy, we shall focus on the experimental aspects and the main strengths of this technique. These are quantitative determination of the element and orbital selective magnetic moments and their anisotropies using magneto-optical sum rules [3]. Hard X-ray MCD measurements that have been performed at the ESRF beamline ID12 on a wide variety of magnetic systems promising for spintronics applications have contributed to a deeper understanding of the microscopic origin of magnetism in these materials. This includes the study of the layer-by-layer magnetic structure in ferromagnets and antiferromagnets, induced magnetism at interfaces, local magnetic moments and their interactions in ferromagnetic semiconductors and half-metalic double perovskites. Finally, determination of the origin of magnetism in diluted magnetic semiconductors is shown as an example of great potentialities of hard X-ray MCD.

References

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