Title
Spin Order and Interfacial Coupling in NiO Systems

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Abstract

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ABSTRACT BODY: Tailoring devices comprised of multiple magnetic layers for applications in information storage technology, requires the precise determination of the spin structure in heteromagnetic nanostructures. Soft x ray magnetic spectroscopies play an important role in improving our understanding of complex magnetic nanostructures since these techniques provide elemental and chemical site specific information with high sensitivity and tunable probing depth. It is clear that using spectroscopic information for magnetometry and magnetic microscopy requires the detailed knowledge and theoretical understanding of spectral shape and magnitude of dichroism signals.

We have recently shown unambiguously that spectral shape and magnitude of the XMLD signal is not only determined by the relative orientation of magnetic moments and x ray polarization, **E**, but that their orientation relative to the crystallographic axes must be taking into account [1].

Ni^{2+} L_2 x ray absorption (XA) spectra from NiO(001) were interpreted in the past assuming that the intensity of the second peak in the Ni L_2 doublet structure is at a maximum when **E** is parallel to the antiferromagnetic axis. However, it follows from our results that, while this is indeed correct for moments and polarization parallel to the [100] direction, for polarization and moments along [110] direction the second peak in Ni L_2 edge is maximum when **E** is perpendicular to the magnetic moments. An equivalent statement is that the sign of the Ni^{2+} L_2 XMLD signal reverses between the [100] and [110] direction. One should realize that this is a peculiarity of the Ni2+ L_2 edge, but not for the L_3 edge.

Since NiO based systems have been studied extensively using Ni L_2 XMLD to elucidate the origin of exchange coupling [2, 3], exchange bias [4] and spin order in antiferromagnets [5] without accounting for the XMLD anisotropy, it is essential to reassess previous Ni^{2+} XMLD data for a proper understanding of these phenomena. For example, a reorientation of Ni moments to inplane for the surface near region of NiO(001) upon Co deposition was observed [2]. For domains with Co moments aligned parallel to the [110] direction, the second peak in the Ni L_2 shows a maximum for **E** parallel [110] indicating that the Ni moments are aligned perpendicular to the [110] direction. Consequently, the coupling between Ni and Co moments is perpendicular – not parallel. In this presentation, we will revisit other previous experimental results and reinterpret the data based on our finding.

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