Resolving the Spin Structure of Antiferromagnets in SOLARIS

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X-ray magnetic linear and circular dichroism (XMLD and XMCD) measurements performed at the XAS end-station in Polish synchrotron SOLARIS enabled us to follow the magnetic properties of epitaxial CoO(111)/Fe(110) and NiO(111)/Fe(110) bilayers. We find that in both studied cases FM sublayer plays a dominant role and determines the magnetic state of the neighboring AFM, however completely different interaction mechanisms are involved. In CoO/Fe bilayers the AFM spins are totally frozen although their orientation is imprinted by magnetization of Fe layer when the system passes the Neel temperature of CoO. Once the Fe layer gratfs the particular magnetic anisotropy (MA) into the CoO overlayer, it later remains frozen and insensitive to external factors like external magnetic field or Fe magnetization direction [1]. In contrast, for NiO/Fe bilayers we find that due to the weak intrinsic MA of NiO, the NiO spins are rotatable and always follow the reorientation of Fe magnetization that can be controlled by external magnetic field or via the temperature and thickness driven spin reorientation of Fe(110). In the case of the temperature induced spin reorientation transition in Fe(110), it allowed us to implement all-temperature, field-free switching of AFM moments in NiO/Fe bilayers [2].

References:

[1] M. Ślęzak et al., Scientific Reports 9 (2019) 889.
[2] M. Ślęzak et al., Nanoscale 12 (2020) 18091.