Supported antiferromagnetism in FeO nanolayers revealed by in-situ nuclear resonant scattering

S. Couet[1,2], K. Schlage[1], R. Rüffer[3], S. Stankov[3], Th. Diederich[1], B. Laenens[2], R. Röhlsberger[1]

[1]Deutsches Elektronen Synchrotron (DESY), Notkestraße 85, 22603 Hamburg, Germany
[2]K.U.Leuven, Instituut voor Kern- en Stralingsfysica & INPAC, Celestijnenlaan 200D, B-3001 Leuven, Belgium
[3]European Synchrotron Radiation Facility (ESRF), BP 220, 38043 Grenoble cedex, France

Ferromagnetic order in thin films is strongly affected when their thickness is reduced to the nanometer regime. The main reasons for this are thermal excitations that lead to fluctuations of the magnetic moments. It is well known that thick antiferromagnetic buffer layers with a high magnetic anisotropy can be used to stabilize magnetic order in ultrathin ferromagnetic films. This effect is of high importance for modern data storage technology. On the way to further miniaturization one consequently asks what happens to antiferromagnetic layers in the ultra thin limit and how are their magnetic properties being influenced by surrounding magnetic material?

These questions were subject of an investigation involving ultrathin layers of Fe and its native oxide studied under ultra-high vacuum conditions by nuclear resonant scattering at the ID18 beamline. The unique opportunity to perform the experiment *in-situ* allowed us to directly unravel the chemical and magnetic changes appearing upon oxidation of an Fe layer and subsequent deposition of Fe. We observed a sudden rise of the Neel temperature of the thin FeO once it is surrounded by ferromagnetic material, thus underlining the intricate influence of ferromagnetic and antiferromagnetic order in nanometer thick layers.