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# Distribution of antiferromagnetic domains in Fe-doped NiO thin films on Ru(0001)

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Antiferromagnetic (AFM) oxide materials in low-dimensional geometries, either in nonmagnetic or magnetic environments, display a rich variety of magnetic behavior. They are very interesting materials to investigate the fundamental physics of finite-size effects in magnetic systems. Despite the limited applications in current technology, AFM oxides are important reference and model systems for studying the interface coupling phenomena that are ultimately exploited in devices such as spin-valves. Furthermore, they are the current focus for next generation of spintronic devices.

Here we demonstrate a route for preparing high quality ultrathin ternary transition metal oxide films on a metallic substrate. Nickel oxides with a small content of iron have been grown on Ru(0001) by oxygen-assisted molecular beam epitaxy at elevated temperatures (1150 K). The nucleation and growth is observed in real time by means of Low Energy Electron Microscopy (LEEM. This enables the optimization of the growth parameters. A comprehensive characterization is performed combining LEEM and LEED for structural characterization and PEEM (PhotoEmission Electron Microscopy) with synchrotron radiation for chemical and magnetic analysis via X-ray Absorption Spectroscopy and X-ray Magnetic Linear Dichroism (XAS-PEEM and XMLD-PEEM, respectively).

We have been able to obtain high quality 2D islands with atomically flat surfaces and a low density of defects. The high crystalline and morphological quality result in optimized properties with respect to films grown by other methods, such as magnetic domains whose size are larger by several orders of magnitude. The spin axis orientation from a single domain area has been extracted applying vectorial magnetometry.

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