Tuning the properties of epitaxial magnetite films by using different single crystal supports: Fe_3O_4(111)/Pt(111) vs. Fe_3O_4(111)/Ru(0001)

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Abstract

Magnetite (Fe_3O_4) is a ferrimagnet and a semiconductor. Low-dimensional magnetite forms, such as nanoparticles or nanometer-thick films, often preserve the properties which makes them promising for application as "building blocks" of nanoelectronic and spintronic devices.

Epitaxial magnetite films were grown on many single crystal supports, including Pt(111) [1] and Ru(0001) [2]. The Fe_3O_4 films grown in (111) direction are particularly interesting, as they exhibit ~85% spin polarization [3]. The structure and properties of epitaxial magnetite can be rendered by the structure and properties of the single crystal support on which the film grows. This can be caused by many different factors, among which lattice mismatch and the corresponding epitaxial strain are of particular importance.

We prepared few-nanometers-thick epitaxial magnetite films on Pt(111) and Ru(0001) and compared their structure and properties. The results indicate significant differences in the structure and properties of magnetite films grown on these two metal single crystal supports with slightly different crystal structure (fcc vs. hcp) and surface lattice constant (2.78 Å vs. 2.71 Å for Pt(111) and Ru(0001), respectively).

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