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## Magnetism of pure and Fe-doped multiferroic CoCr2O4 thin films under strain

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Mutliferroic materials are under investigation due to the prospect of controlling the magnetic state with electrical potentials or vice versa. We present an investigation of thin film multifferroic  $CoCr_2O_4$  (CCO) in pure and Fe-doped form grown with different crystallographic orientation and strain on either MgAl<sub>2</sub>O<sub>4</sub>(001) (MAO) or Al<sub>2</sub>O<sub>3</sub>(0001) (ALO) substrates. Bulk CCO shows a ferrimagnetic transition temperature at about 95 K with 0.08  $\mu_B/f.u.$  and a transition into a conical spin state with multiferroic character at 26 K [1]. The doping with Fe leads to different sublattice magnetizations, magnetic compensation and increased transition temperatures [2].

Both substrates accommodate epitaxial growth of CCO, while the lattice mismatch of about 3% leads to a compressive strain. CCO on MAO follows the orientation of the substrate with a (001) film normal. The oxygen sublattice match of the (0001) ALO plane leads to a (111) growth. Polarized neutron reflectometry, in combination with several complementary techniques, is used to investigate the chemical and magnetic morphology as a function of depth. The measurements reveal a homogeneous magnetization profile with a magnetization 0.18  $\mu_B/f.u.$  at 2 K, which is higher than reported magnetizations in bulk. Despite the large strain, the substrate interfaces are sharp and structural and magnetic effects do not exceed 5 nm. We will compare these results to the magnetization behavior of thin film Fe-doped CCO.

[1] Y. Yamasaki et al. PRL 96, 207204 (2006).

[2] R. Padam et al. APL 102, 112412 (2013).

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