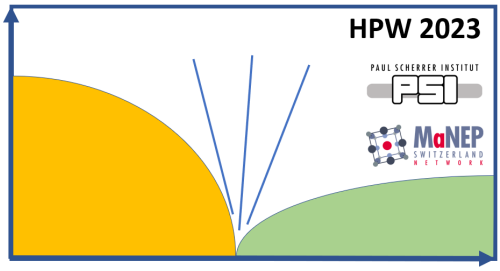

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Magnetic properties of strained (010)-DyFeO3 thin films and single crystals

Wednesday, 22 November 2023 16:00 (15 minutes)

Strain in antiferromagnetic orthoferrite thin films is predicted to significantly change magnetic properties and result in a polar response up to room temperature. Orthorhombic DyFeO₃ is of particular interest since the Fe-spins undergo a spin-reorientation with transition temperatures depending strongly on the Dy-Fe interaction and a magnetic field induced ferroelectric phase below the Dy ordering temperature of 4K. To gain an understand of the magnetic properties of highly strained, coherently grown (010)-oriented DyFeO₃ thin films we studied the pressure dependence of a DyFeO₃ single crystal at the thermal triple-axis spectrometer EIGER, SINQ. The scattering experiments were conducted in the (*0kl*) scattering plane in the temperature range between 1.5 and 100K. For the pressure dependent measurements, a helium gas pressure cell has been used with a max reachable pressure of 5 kbar to study the spin reorientation transition (T_{SR}) at 40K under uniaxial pressure conditions. In the temperature regime of interest, the He-pressure cell has the advantage that the pressure medium is still liquid and the applied pressure therefore truly isostatic. For the single crystal we measure an increase in T_{SR} with a rate of 1K/500bar. As a rule of thumb, a lattice mismatch between film and substrate of 1% corresponds roughly to a chemical pressure of 10kbar. Hence a T_{SR}=70K equals a measured film lattice change of approximately 3%. Overall, pressure depedent magnetic data for a DyFeO₃ single crystal are in broad agreement with values obtained for highly strained thin films.

Primary author: SCHNEIDER, Christof (PSI - Paul Scherrer Institut)

Co-authors: BISWAS, Banani (PSI - Paul Scherrer Institut); Dr NAUMOV, Pavel (PSI); Mr STUHR, Uwe Hans-Arnim (PSI - Paul Scherrer Institut); HAUTLE, Patrick (Paul Scherrer Institut); BARTKOWIAK, Marek (Paul Scherrer Institut); LIPPERT, Thomas (Paul Scherrer Institut)

Presenter: SCHNEIDER, Christof (PSI - Paul Scherrer Institut)

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