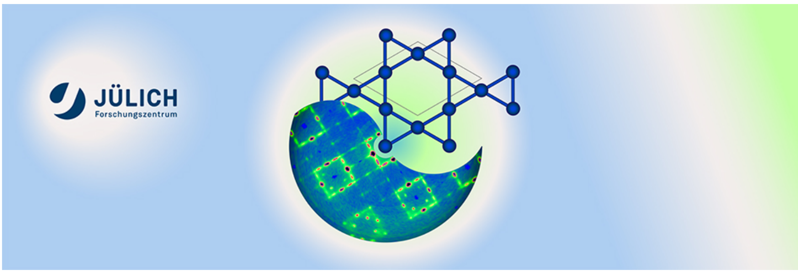

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Structural and Magnetic Characterization of RCrO3 (R = Ho, Gd) Complex Perovskites

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Rare-earth orthochromites ($RCrO_3$) have attracted widespread attention in recent years due to their rich physical properties and potential applications in spintronics, thermomagnetic switches, photocatalysts, and low-temperature magnetic refrigeration [1-3]. $RCrO_3$ exhibits canted antiferromagnetic behavior with the canting caused by the Dzyaloshinskii–Moriya interactions and the interaction between Cr^{3+} and rare-earth magnetic sublattices, the latter of which also leads to negative magnetization under certain thermal and magnetic conditions [1]. These interactions and magnetic frustration lead to deviations from classical Curie–Weiss behavior at low temperatures. Among all the rare-earth orthochromites, we chose HoCrO3 (HCO) for our study, because in this compound, the Ho3+ ion owns a large magnetic moment ~ 10.6 μB. From the Curie-Weiss fit of magnetic susceptibility data, we observed a large negative value of the Weiss temperature, which showed the antiferromagnetic nature and magnetic frustration in the compound. We also found very large values of the magnetocaloric parameters [3]. This study opens an avenue for further investigation of other rare-earth metals to explore magnetic frustrations. GdCrO3 is another promising candidate for a variety of physical applications, especially its magnetic and giant magnetocaloric properties [4].
Therefore, in our current study, we aim to grow high-quality single crystals of GdCrO3 for detailed neutron scattering experiments to elucidate frustrated magnetic states and correlated spin dynamics. The prepared polycrystalline precursors were characterized using powder X-ray diffraction followed by Rietveld refinement to determine their structural and microstructural properties. Furthermore, magnetic studies revealed a negative magnetization at low temperatures, along with spin reorientation behavior. By fitting the dc magnetization data with the modified Curie–Weiss law, including the Dzyaloshinskii–Moriya antisymmetric exchange interaction (D) and the symmetric exchange constant (J), these parameters were obtained. This comprehensive characterization shows the precursors to be highly suitable for crystal growth, which is currently being pursued with laser floating-zone furnace. Available first results on crystals would be shown as well.

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