Magnetism, Magnetotransport and Magnetic Structure of $ThCu_3Mn_4O_{12}$, Prepared at Moderate Pressures

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Dedicated to Professor Gérard Demazeau on the occasion of his 65th birthday

The complex perovskite $ThCu_3Mn_4O_{12}$ has been prepared at moderate pressures of 2 GPa. With respect to the parent compound $CaCu_3Mn_4O_{12}$, the replacement of Ca^{2+} by Th^{4+} involves a double electronic injection that leads to a substantial increment of T_C, up to 370 K. The crystal structure was refined in the space group $Im\bar{3}$ from NPD data collected with λ = 1.33 Å at r. t. An additional NPD pattern recorded at 1.8 K with λ = 2.42 Å allowed to refine the magnetic structure, which displays a ferrimagnetic coupling between Mn^{3+}/Mn^{4+} and Cu^{2+} spins, aligned along the *c* direction. The refined magnetic moments at the Mn and Cu substructures of 2.5 and −0.5 μ_B, respectively, account for the observed saturation magnetisation at 2 K, of 7 μ_B/f. u. A semiconducting behaviour is observed between 10 and 350 K which can be correlated with the appearance of a gap in the conduction band for the ∼50 % Mn^{3+}/50 % Mn^{4+} mixed valence observed in the B substructure of this perovskite.

Key words: Perovskite Oxide, Colossal Magnetoresistance, Ferrimagnetic Oxide, Neutron Powder Diffraction, Mn Mixed Valence, High-pressure Synthesis