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Intermediate Valence Effect of Ce in Structural and Magnetic Properties of Ceramic $Sm_2MnCeO_{6+\delta}$

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Abstract : This investigation concentrates on the complex interrelations of intermediate valence states of cerium (Ce^{3+}/Ce^{4+}) and their respective contributions to distinctive magnetic phenomena, including antiferromagnetic (AFM) and ferromagnetic (FM) orderings, in addition to Griffith's phase. The $Sm_2MnCeO_{6+\delta}$ (SMCO) ceramic was prepared using the high-temperature solid-state method and crystallized in a cubic crystal structure with an Ia3d space group, possessing a uniform distribution of constituent elements. Magnetic susceptibility measurements reveal a Néel temperature (TN) of 13.8 K, indicating AFM behaviour, alongside evidence of Griffith's phase (GP) dynamics, $46.2 \leq T \leq 139.1$ K. This phase follows a ferromagnetic (FM) ordering at Curie temperature (TC) of 43.7 K, which is an indication of the presence of short-range ordering of spins. The simultaneous presence of various oxidation states and their influence on both magnetic and structural characteristics positions SMCO as a versatile material proficient in functioning under elevated temperature conditions. This research paves the way for innovative applications of magnetic ceramics in the realms of catalysis, solid oxide fuel cells (SOFCs), and spintronics devices.

Keywords : $Sm_2MnCeO_{6+\delta}$, ceramics, Néel temperature, Curie temperature, Griffith's phase
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