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Synthesis and characterization of Gd₂CoTO₆ (T = Mn, Fe)

The occurrence of negative magnetization (NM) refers to a switch from positive magnetization to negative values with the application of a positive probing magnetic field below the temperature having a magnetically ordered phase, which can rarely be caused by diamagnetism [1]. Such a novel phenomenon has created curiosity due to two states such as positive and negative magnetization as a function of applied magnetic field (H) and temperature (T) and also the property of the system [2]. Previous reports on La_{1.5}Sr_{0.5}Co_{1−x}Fe_xMnO₆ [3], Er₂CoMnO₆ [4] and Gd₂CoRuO₆ [5], quaternary double perovskites with the empirical formula R₂TT'O₆ (R: rare-earth ions; T and T': transition metal ions) not only demonstrate features like NM but also concurrently show inverse exchange bias effect, arising be-cause of the complex interplay at the interface of ordered phase with disordered phase due to antisite formation, and neighboring magnetic clusters. Double perovskites (DPs) of the form R₂TT'O₆ have opened up research avenues because of their significant physical properties such as magnetocaloric effect, metamagnetism, and exchange bias in addition to NM [6]. Intrinsic NM effect characterized by magnetization measured under field (M_{FC}) less than zero under positive cooling fields H_{cool} was observed in the Gd₂Co_{2−x}Mn_xO₆ compounds from x = 1.1 to 1.5. The results conclude that the inverse nature of exchange bias has the same cause as NM, which is ascribed to the opposite alignment of the resultant ferromagnetic moments to the applied cooling field below the magnetic compensation point. The present work presents a simple sol-gel method to synthesize Gd₂CoTO₆ (T= Mn, Fe) samples together with characterization of the compounds through different measurement techniques in order to compare the physical properties with those reported in literature.

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