Large drop in dielectric constant at ferrimagnetic ordering of CoCr₂O₄ thin film as observed by terahertz time domain spectroscopy

K.R. MAVANI, M. NAGAI, M. SHIRAI, K. TANAKA, Dept. of Physics, Kyoto University, D.S. RANA, I. KAWAYAMA, M. TONOUCHI, Inst. of Laser Engr., Osaka University — Multiferroic spinel CoCr₂O₄ shows ferrimagnetic transition at \( \sim 95 \) K and, at further low temperatures, it shows development of magnetic spin spirals simultaneous to a ferroelectric transition. We have deposited epitaxial CoCr₂O₄ thin film on MgO(100)substrate and studied the film using temperature dependent terahertz (THz) time-domain spectroscopy. There is a large drop in the dielectric constant \( (\varepsilon_1) \) to nearly half of its initial value at ferrimagnetic transition of CoCr₂O₄ thin films in the THz frequency range. This is contrary to few earlier studies by capacitance measurements which showed no significant change in the dielectric constant \( (\varepsilon_1) \) at ferrimagnetic transition [1]. At lower temperatures, two dielectric anomalies were observed in the temperature dependent \( \varepsilon_1 \), which correspond to the onset of short-range magnetic spin spirals \( (\sim 50 \) K) and the long-range ordering of the spirals at lower temperature \( (\sim 26 \) K). Our results indicate a magnetoelectric effect at the ferrimagnetic transition of CoCr₂O₄ thin film in THz frequency range.


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