Electric field induced metal-insulator transition and colossal magnetoresistance in CdCr$_2$S$_4$

C.P. SUN, C.C. LIN, J.L. HER, S. TARAN, C.C. CHOU, C.L. CHAN, C.L. HUANG, Department of Physics, Center for Nanoscience and Nanotechnology, National Sun Yat-Sen University, Kaohsiung 804, Taiwan, H. BERGER, Institutes of Physics of Complex Matter, EPFL, Lausanne, Switzerland, H.D. YANG, Department of Physics, Center for Nanoscience and Nanotechnology, National Sun Yat-Sen University, Kaohsiung 804, Taiwan — Multiferroic ordering existing in a single material is a recent hot topic in the field of condensed matter physics due to its potential application in device control. The chromium chalcogenide spinel CdCr$_2$S$_4$ is one of the attractive materials investigated by Hemberger et al. recently.[1] Based on the electrical measurement, there is no discontinuity through the ferromagnetic ordering at $T_C \sim 85K$.[2] We measure the temperature dependent resistance under various electric fields to investigate the electrical properties of the present material. To our knowledge, we first observe the electric field induced metal-insulator transition in this material around $T_C$. Moreover, a colossal magnetoresistance (CMR), which is comparable to that of manganese-based CMR material, is also observed near $T_C$. The origin for these properties is discussed. [1] J. Hemberger, P. Lunkenheimer, R. Fichtl, H.-A. Krug von Nidda, V. Tsurkan, A. Loidl, Nature 434, 364 (2006). [2] P. K. Baltzer, H. W. Lehmann, and M. Robbins, Phys. Rev. Lett. 15, 493 (1965).

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