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Hysteretic phenomena in multiferroic $HoMnO_3$ EDUARD GALSTYAN, BERND LORENZ, TcSUH, University of Houston, MARIN GOSPODINOV, Institute of Solid State Physics, Bulgarian Academy of Science, KAREN MARTIROSYAN, Chemical Enginnering, University of Houston, PAUL CHU, Hong Kong University of Science and Technology, TcSUH, Lawrence Berkeley National Laboratory — The hexagonal $HoMnO_3$ is multiferroic with ferroelectric transition at T_C=875 K, the Mn^{3+} moments order at T_N=72 K, Mn^{3+}- spin reorientation transitions occur at T_{sp1}=34 K and T_{sp2}=4.9 K, and magnetic Ho^{3+} orders at $T_{Ho} \sim 5.2$ K. Our dc susceptibility measurements of $HoMnO_3$ single crystal under both zero-field cooled (ZFC) and field-cooled (FC) conditions at low applied magnetic fields reveal un unusual anomaly. In particular, below 4.9 K, the out-of-plane susceptibility (c-axis magnetization) is higher in the case of a ZFC measurement compared with that of a FC measurement. Above 4.9 K, the ZFC curve is lower than the FC curve, as well as for the in-plane susceptibility measurement in the temperature range below T_N=34 K. We assume that these phenomena are related to the magnetic and ferroelectric domain boundary structures and sensitively respond to changes of the magnetic structure such as spin-rotations at the phase transitions. We also have observed a sizable difference in the magnetization of $HoMnO_3$ polycrystalline samples with nano and micro size particles.

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