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Temperature-dependent electrical and electro-optical properties of $LuFe_2O_4$ thin films RAM RAI, B.S. FRANKS, Department of Physics, SUNY College at Buffalo, NY 14222, B. CAI, M.L. NAKARMI, Department of Physics, Brooklyn College of the CUNY, Brooklyn, NY 11210 — We present temperature-dependent electrical properties of $LuFe_2O_4$ (LFO) thin films deposited on (001) sapphire substrates. The Hall-effect measurements of LFO thin films showed the p-type conductivity at temperatures above 440 K, which is the 2D charge-ordered (CO) state of LFO. In the 3D CO stated below 340 K, we observed complex electrical properties of LFO thin films: dc voltage-current measurements displayed a hysteresis behavior and transient response of voltage-under-current pulses showed a nonlinear voltage-current relationship. We also present the electro-optical effects of LFO in the photon energy range of 0.5 - 6 eV. At 170 K, LFO thin films show the electro-optical effects of size up to 8% near Fe^{2+} d to d on-site electronic transitions. The electrical and electro-optical properties of LFO thin films could be associated with the changes of the ferroelectric polarization in applied electric fields through the interplay of the spin, charge, and lattice degrees of freedom in the multiferroic state of LFO. We will discuss the measured data in the view of the Maxwell-Wagner effects at the contacts, and demonstrate that LFO does show the ferroelectric state below 330 K.

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