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Investigation of Electrically Driven Phase Transition in Magnetite Thin Films[1] ALEXANDRA A. FURSINA, Department of Chemistry, Rice University, 6100 Main st. Houston, TX, 77005, R.G. SUMESH SOFIN, IGOR V. SHVETS, CRANN, School of Physics, Trinity College, Dublin 2, Ireland, DOUGLAS NATELSON, Department of Physics and Astronomy, Rice University, 6100 Main st. Houston, TX, 77005 — Magnetite, Fe_3O_4, is an example of strongly electronically correlated system. It undergoes so called Verwey transition at T_V ∼122 K accompanied both by structural distortion and drastic decrease in electrical conductivity, i.e. metal-insulator transition. Recently, we discovered a new electrically driven phase transition in magnetite nanoparticles and thin films. We observed that a low-temperature (T below T_V) insulating state is broken upon applying an electric field, resulting in a sharp transition to the state with much higher conductivity. We report on further electrical characterization of this newly discovered state. There is a question whether this state is the same as high-temperature phase above T_V or this is a new state of magnetite. In standard two-terminal measurement dominant contribution of contact resistance impedes intrinsic electrical properties. Thus, four-terminal configuration is necessary. Electrical and magnetoresistance properties are measured in challenging four-terminal geometry at nanoscale.

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