Temperature dependent electrical properties of the epitaxial junction between Nb: SrTiO$_3$ and magnetite (Fe$_3$O$_4$) S.B. OGALE, DARSHAN C. KUNDALIYA, S. DHAR, S.R. SHINDE, T. VENKATESAN — Epitaxial films of magnetite (Fe$_3$O$_4$) were grown on single crystal (001) Nb: SrTiO$_3$ substrates by pulsed laser deposition. The films were characterized by x-ray diffraction, Rutherford backscattering-ion channeling spectrometry, SQUID, and four probe resistivity measurements. The growth conditions were optimized to achieve good crystallinity as well as the expected transport and magnetic characteristics of the Verwey transition at 120 K. Such junctions were then examined for the temperature dependent current-voltage (I-V) characteristics, which exhibited a non-linear behavior and an interesting non-monotonic temperature dependence. The data were also recorded in magnetic field up to 5 Tesla. These data were analyzed within the framework of a band description of transport across the interface between dissimilar semiconducting oxides and the fitting parameters were extracted. The temperature evolution of these parameters showed systematic trends, with interesting changes near the Verwey transition. These data are analyzed based on the electronic density of states and the nature of transport in magnetite. 1. Z. Zhang et al. Phys. Rev. B 44, 13319 (1991), 2. D. Ihle et al. J. Phys. C : Solid State Phys. 19, 5239 (1986), 3. S. B. Ogale et al. Phys. Rev. B 57, 7823 (1998).

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