Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Temperature-dependent photoluminescence studies of $GdTiO_3$ thin films[1] AMIT VERMA, Dept. of Electrical Engineering, Univ. of Notre Dame, SANTOSH RAGHAVAN, Materials Dept., University of California, Santa Barbara, VLADIMIR PROTASENKO, Dept. of Electrical Engineering, Univ. of Notre Dame, SUSANNE STEMMER, Materials Dept., University of California, Santa Barbara, DEBDEEP JENA, Dept. of Electrical Engineering, Univ. of Notre Dame — $GdTiO_3$ (GTO), a Mott-insulator, has acquired increased prominence in last few years since the discovery of a 2-dimensional electron gas (2DEG) at its heterojunction with the band-insulator $SrTiO_3$. These 2DEGs have very large electron densities ($\sim$3x10^{14} cm^{-2}) amounting to half electron per unit cell. To realize many possible applications of this large 2DEG, an understanding of the GTO bandstructure is needed. With this goal in mind, in this work we present photoluminescence (PL) studies of GTO thin films (10nm and 20nm) grown by molecular beam epitaxy (MBE) on (001) LSAT substrates. When pumped with a 325 nm He-Cd laser, we observe a red PL ($\sim$683 nm at 300K) from both GTO thin films at RT. Upon lowering the temperature from 300K to 80K, the PL peak blue shifts by $\sim$0.14eV. Interestingly, the reported activation energy of the resistivity of MBE-grown GTO thin films is also $\sim$0.14eV (Moetakef et al., J. Crystal Growth 355, 166 (2012)). We connect the observed temperature-dependent PL data with the expected electronic bandstructure and electrical resistivity, and explain the sharp transition in the peak that occurs between 120K-200K from $\sim$636nm to $\sim$683nm.

[1]Office of Naval Research through grant number (N00014-12-1-0976).

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Date submitted: 19 Nov 2012 Electronic form version 1.4