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Irreversibility and carriers control in two-dimensional electron gas at $LaTiO_3/SrTiO_3$ interface N. BERGEAL, J. BISCARAS, S. HURAND, C. FEUILLET-PALMA, J. LESUEUR, ESPCI ParisTech-CNRS, A. RASTOGI, R.C. BUDHANI, IIT kanpur, N. REYREN, E. LESNE, UMR Thales-CNRS, D. LEBOEUF, C. PROUST, LNCMI — It has been shown recently that a two-dimensional electron gas 2DEG could form at the interface of two insulators such as $LaAlO_3$ and $SrTiO_3$ [1], or $LaTiO_3$ (a Mott insulator) and $SrTiO_3$ [2-3]. We present low temperature transport measurements on $LaTiO_3/SrTiO_3$ and $LaAlO_3/SrTiO_3$ hetero-structures, whose properties can be modulated by field effect using a metallic gate on the back of the substrate [4]. Here we show that when the carrier density is electrostatically increased beyond a critical value, the added electrons escape into the $SrTiO_3$ leading to an irreversible doping regime where all the electronic properties of the 2DEG saturate (carrier density, resistivity, superconducting transition...). The dynamic of leakage was studied using time resolved measurement. Based on a complete self-consistent description of the confinement well, a thermal model for the carriers escape has been developed, which quantitatively accounts for the data [5].

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