Electric field modulation of superconductivity and kondo effect in LaAl$_{1-x}$Cr$_x$O$_3$/SrTiO$_3$ interfaces GYANENDRA SINGH, ALEXIS JOUAN, SIMON HURAND, CHERYL PALMA, LPEM -CNRS-ESPCI ParisTech-UPMC, 10 Rue Vauquelin - 75005 Paris, France, PRAMOD KUMAR, ANJANA DOGRA, RAMESH BUDHANI, National Physical Laboratory, New Delhi 110012, India, JEROME LESUEUR, NICOLAS BERGEAL, LPEM -CNRS-ESPCI ParisTech-UPMC, 10 Rue Vauquelin - 75005 Paris, France — Two dimensional electron gas exhibit superconductivity and spin orbit coupling (SOC) at the interfaces of two insulators LaXO$_3$/SrTiO$_3$ (where X = Al, Ti and Ga) [1-3], whereas no conductivity is seen when X site is replaced by Cr and Mn [4]. We present low temperature measurements of LaAl$_{1-x}$Cr$_x$O$_3$/SrTiO$_3$ interfaces for Cr doping of x = 0, 0.1, 0.2. We show a sharp superconducting transition ($T_c$) at 175 mK for undoped sample (x = 0) which becomes broader for the Cr doping of x = 0.1 with $T_c$ of 100 mK. Further Cr doping to x = 0.2 indicate no sign of superconductivity. We have analyzed the results with hall carrier density and SOC as a function of Cr doping. The temperature dependent sheet resistance below 50 K display an upturn for x = 0 which becomes more pronounced with Cr doping. We discuss the result on the basis of kondo scattering which can be modulated by varying the carrier density.


Gyanendra Singh
LPEM -CNRS-ESPCI ParisTech-UPMC, 10 Rue Vauquelin - 75005 Paris, France

Date submitted: 14 Nov 2014 Electronic form version 1.4