Modified doping at cuprate / lanthanum manganite interfaces

JACOBO SANTAMARIA, J. GARCIA BARRIOCANAL, A. RIVERA, C. LEON, GFMC. Fac. Fisicas. U. Complutense, Madrid Spain, M. VARELA, Materials Science & Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN, USA, S.J. PENNYCOOK, Materials Science & Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN, USA, Z. SEFRIOUI, GFMC. Fac. Fisicas. U. Complutense, Madrid Spain. — Oxide heterostructures allow combining materials with similar structure but with very different ground states, which may compete at the interface to yield novel behaviors and functionalities. We explore the YBa$_2$Cu$_3$O$_7$ (YBCO) / La$_{1-x}$Ca$_x$MnO$_3$ (LCMO) interface in thin film heterostructures. For $x=0.3$ the manganite is ferromagnetic which causes a strong depression of the superconductivity at the YBCO side. There is also a depression of the ferromagnetic moment at the interface suggesting electron transfer from the manganite into the YBCO. This is confirmed from superlattices alternating YBCO and LaMnO$_3$ (LMO), an A- type AF insulator. While for thin LMO layers ($<6$ unit cells) there is little effect on YBCO superconductivity, thicker LMO layers result in reduced Tc values and induced ferromagnetism at the interface, thus providing a firm indication of charge transfer. The occurrence of charge transfer over length scales much longer than the Thomas Fermi screening length (1 nm) is a novel behavior which, we hope, will stimulate future theoretical studies. Work supported by CICYT MAT2005 06024 C02-02.

Jacobo Santamaria
GFMC. Fac. Fisicas. U. Complutense, Madrid Spain

Date submitted: 20 Nov 2006