Poster

ELECTRICAL RESISTANCE MAPPING OF OXIDE FERROMAGNETIC ELECTRODES AND TUNNEL BARRIERS BY CONDUCTING ATOMIC FORCE MICROSCOPY

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Since the discovery of colossal magnetoresistance in manganites, there is a high interest in the fabrication of magnetic tunnel junctions made with all-oxide ferromagnetic electrodes and barrier. (001)-oriented $La_{2/3}Ca_{1/3}MnO_3$ (LCMO) and $SrTiO_3$ (STO) films are the most investigated materials as ferromagnetic electrode and tunnel barrier, respectively. The usefulness of these oxides for the application is well demonstrated, but there is a high reduction of the operation temperature that limits its use. Overcoming the reduction of properties at high temperature is a challenge. The cause of the reduction is not well understood, although electronic segregation at interfaces is likely to be at the origin.

As electrical and structural stability of an interface largely depend on its atomic composition, it is worth to explore magnetic tunnel junctions based on atomic interfaces other than the (001). With this goal, we have grown LCMO films and STO/LCMO bilayers on $SrTiO_3$(110) substrates. It is found that lattice strain and surface topography of the LCMO electrode depend greatly on the orientation, which is determined by the substrate. Interestingly, we have found that LCMO(110) films show a more robust ferromagnetism than the LCMO(001) oriented films.

The different lattice strain state in both sets of films and the atomic arrangement at surfaces is expected to eventually lead to different electronic phase segregation. Aiming to get insight on differences on electronic phase segregation at surfaces and interfaces, we have used conducting atomic force microscopy. Topographic and electrical resistance images are compared, and spectroscopic I-V curves are taken at selected sites. Both bare ferromagnetic LCMO electrodes and nanometric STO barriers on the electrodes have been characterized, and we compare high quality epitaxial films and bilayers grown on (001) and (110) $SrTiO_3$ substrates.