T_CSUH Bi-Weekly Seminar

Texas Center for Superconductivity at the University of Houston

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"Strain and n-Type Doping Effects on Colossal Magnetoresistance Films"

Friday, August 18, 2006
Room 102, University of Houston Science Center
12:00 noon – 1:00 p.m.

Abstract

The mechanism of strain effect and the achievement of n-type doping on colossal magnetoresistance (CMR) films has been debated and tried for the past decade. It has been believed, but there has been a lack of direct evidence to support, that the distorted MnO_6 octahedron due to in-plane strain effect causes the change of transport and magnetic properties. To investigate the origin of the strain effect, $La_{0.7}Ca_{0.3}MnO_3$ and $La_{0.8}Ba_{0.2}MnO_3$ films with various thicknesses grown on $SrTiO_3$ substrates were examined by Near Edge X-ray Absorption Spectroscopy (NEXAS). This study finds that the strain doesn't affect the MnO_6 octahedron significantly, but weakens substantially the La-O and Ca-O (or Ba-O) hybridization, which is responsible for the reduction and the enhancement of T_C in $La_{0.7}Ca_{0.3}MnO_3$ and $La_{0.8}Ba_{0.2}MnO_3$ strain films, respectively. For the n-type CMR issue, it has been believed that an n-type CMR can be realized by partially substituting tetravalent ions on trivalent La^{3+} sites. By investigating the $La_{0.7}$(Ce or Te)$_{0.3}MnO_3$ bulks with SEM and EDS, it is found that the compound decomposed into $La_{0.9-\varepsilon}Ce_\varepsilon MnO_{3+\varepsilon}$, Mn-O, and CeO_2, none of which contained original stochiomatry. The n-type compound cannot be formed in thermal equilibrium process, such as post annealing. Only those under metastable processing such as in-situ epitaxial films can possibly assist in forming n-type CMR.

Bio

Prof. Hsiung Chou is a Professor of Physics at National Sun Yat-sen University in Kaohsiung, Taiwan. He received his Ph.D. in Materials Science from Columbia University in 1992. Prof. Chou's research interests include microstructure and the pinning effect on CMR thin films, mechanism of strain effect on CMR thin films, magnetic coupling in CMR heterorgrains and heterorjunctions, n-type CMR materials, and p-n junction and MTJ in CMR materials.

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