Modifications in the electronic and magnetic properties of transition metal oxides thin films due to strain

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ABSTRACT

The wide range of exotic structural, electronic, dielectric and magnetic properties exhibited by the transition metal oxides (TMOs) emanate from the competing forces encountered by transition metal (TM)-3*d* electrons, such as electron-electron Coulombic interaction which favors localization of electrons, and TM 3*d*-O 2*p* hybridization which facilitates the electrons delocalization. The competition governs the nature of gap, if it is Mott Hubbard type or charge transfer energy type. To embrace these materials for electronic devices, it is very crucial to probe the type and origin of the band gap. Strain engineering in thin films of these materials provides a window to tune these parameters and hence control their electronic and magnetic ground states. However, generally strained films also suffer from other defect states, such as oxygen vacancy, local distortion etc. and hence it is difficult to conclude the origin of modification in the physical properties in such films. It is of huge importance and fundamental in nature to ascertain an unequivocal origin of modifications in electrical, electronic and magnetic properties, in order to tune their properties. In the last few years, our group has been actively involved in tuning and probing electronic and magnetic ground states of thin films of TMOs using XANES, XMCD and RPES studies at Indus synchrotron sources. I shall discuss the efficacy of these techniques which unambiguously unravel the coupled structural, electronic and magnetic properties of some TMOs thin films prepared by PLD technique.

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