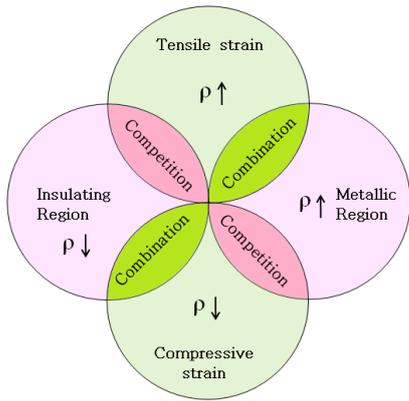
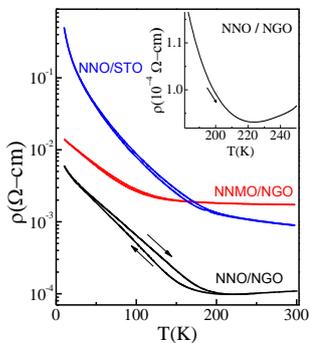


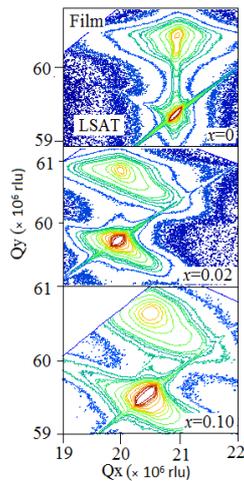
## Controlling the electronic state by strain and Mn-doping in epitaxial thin films of NdNiO<sub>3</sub>



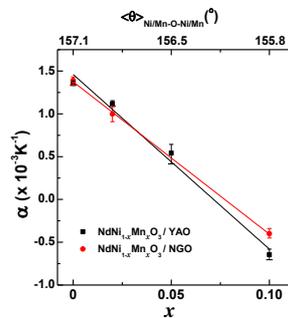
Venn diagram showing competing and combining effect of strain and Mn-doping in NdNiO<sub>3</sub> thin films



Temperature dependent resistivity showing competing and combining effects of tensile strain and Mn-doping



Reciprocal space mapping of thin films deposited on LSAT.



Linear change in temperature coefficient of resistivity and corresponding change of bond angle due to Mn-doping.

RNiO<sub>3</sub> (R= Rare earth ion) compounds have applications in switches, sensors, photovoltaics and multiferroic devices. This system shows a temperature driven first order metal to insulator transition, which is very sensitive to the external perturbations. We have studied a combined effect of Mn-doping and epitaxial strain on the metallic as well as insulating state of NdNiO<sub>3</sub> thin films. The Reciprocal space maps show that undoped thin film is epitaxial and the epitaxy is maintained till higher Mn-doping. Our study reveals that a slight increase in the tensile strain via lattice mismatch can result in an order of magnitude difference in the resistivity for pure NdNiO<sub>3</sub> thin films<sup>1,2</sup>. Moreover, the temperature dependent resistivity curves of pure NdNiO<sub>3</sub> films demonstrate that the tensile strain increases the resistivity in a similar way for all temperatures. However, a crossover of resistivity curves is observed due to competing effects of doping and strain. The Venn diagram<sup>3</sup> depict that depending upon the temperature region, the effect of tensile and compressive strain on metallic and insulating states, either compete (dark pink region) or combine (dark green region) with those of Mn-doping.

<sup>1</sup>Charge Transport in NdNiO<sub>3</sub> Thin Films: Effects of Mn-doping versus Tensile Strain, Mahesh Chandra, Fozia Aziz, Rakesh Rana, Ravikiran Late, D. S. Rana, K. R. Mavani, AIP Conf. Proc. 1591, 1375 (2014).

<sup>2</sup>Large Effects of Epitaxial Tensile Strain on Electrical Transport of Mn-doped NdNiO<sub>3</sub> Thin Films, Mahesh Chandra, Sarmistha Das, Fozia Aziz, Shivendra Tripathi, K. R. Mavani, Solid State Commun. 219, 16–20 (2015).

<sup>3</sup>Competing Effects of Mn-doping and Strain on Electrical Transport of NdNi<sub>1-x</sub>Mn<sub>x</sub>O<sub>3</sub> (0 < x < 0.10) Thin Films, Mahesh Chandra, R. Rana, Fozia Aziz, Amit Khare, D. S. Rana and K. R. Mavani, J. Phys. D: Appl. Phys. 46, 415305 (2013).