Optical properties of lattice tuned $RNiO_3$

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Rare-earth nickelates with the composition $RNiO_3$ where R is a trivalent rare earth ion, are among the few perovskite oxides showing a very sharp Metal-Insulator (MI) and a low temperature antiferromagnetic ordering. The energy scale of both MI and magnetic transitions can be tuned by the nature of the rare-earth and the strain applied through the lattice mismatch between the substrate and the film. Using spectroscopic ellipsometry in the visible range and transmission and reflectivity in the infrared, we extracted the temperature dependence of the optical conductivity of films of varying composition and strain. The spectra show strong qualitative changes on the scale of 1 eV when the material passes through the metal-insulator transition, and additional weaker changes when it passes from the paramagnetic to the magnetically ordered phase. The spectral changes reveal the effect of charge-ordering on the local electronic configuration of the nickel ions, and point toward a situation whereby the charge ordered state is characterized by two types of nickel with qualititively different electronic configurations.

References:

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