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Reversal of lattice, electronic structure, and magnetism in epitaxial $SrCoO_x$ thin films[1] H. JEEN, W.S. CHOI, J.H. LEE, V.R. COOPER, H.N. LEE, Oak Ridge National Laboratory, USA., S.S.A. SEO, University of Kentucky, USA., K.M. RABE, Rutgers University, USA. — $SrCoO_x$ (x = 2.5 – 3.0, SCO) is an ideal material to study the role of oxygen content for electronic structure and magnetism, since SCO has two distinct topotactic phases: the antiferromagnetic insulating brownmillerite $SrCoO_{2.5}$ and the ferromagnetic metallic perovskite $SrCoO_3$. In this presentation, we report direct observation of a reversible lattice and electronic structure evolution in $SrCoO_x$ epitaxial thin films as well as different magnetic and electronic ground states between the topotactic phases.[2] By magnetization measurements, optical absorption, and transport measurements drastically different electronic and magnetic ground states are found in the epitaxially grown $SrCoO_{2.5}$ and $SrCoO_3$ thin films by pulsed laser epitaxy. First-principles calculations confirm substantial, which originate from the modification in the Co valence states and crystallographic structures. By real-time spectroscopic ellipsometry, the two electronically and magnetically different phases can be reversibly changed by changing the ambient pressure at greatly reduced temperatures. Our finding provides an important pathway to understanding the novel oxygen-content-dependent phase transition uniquely found in multivalent transition metal oxides.

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[2]W. S. Choi *et al.*, Phys. Rev. Lett. **111**, 097401 (2013).

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