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Growth and Electronic Structure Characterization of $(SrCoO_x)_n$:$(SrTiO_3)_1$ Superlattices SAY YOUNG COOK, Department of Materials Science and Engineering, Northwestern University, TASSIE ANDERSEN, Northwestern University, RICHARD ROSENBERG, HAWOONG HONG, Argonne National Laboratory, LAURENCE MARKS, Northwestern University, DILLON FONG, Argonne National Laboratory — We report on the synthesis of a $(SrCoO_x)_1$:$(SrTiO_3)_1$ superlattice by oxide molecular beam epitaxy and the characterization of its electronic structure by soft x-ray spectroscopy. X-ray photoelectron and absorption spectroscopy reveal that Ti remains octahedrally coordinated with a 4+ oxidation state, while the Co oxidation state is intermediate of 3+ and 4+. Despite having the same half an oxygen vacancy per Co atom found in brownmillerite $SrCoO_{2.5}$, which consists of alternating tetrahedral and octahedral layers of Co, the confinement of oxygen vacancies to isolated single atomic layers of $SrCoO_x$ stabilizes square pyramidal coordination of Co, as observed by the linear dichroism in the Co 2p-3d x-ray absorption. The corresponding stabilization of Co^{4+} along with Co^{3+} within the square pyramidal $SrCoO_{2.5}$ layers gives rise to a Fermi-edge step observed at strong Co 2p-3d resonance in the resonant photoemission spectroscopy of the valence band, and reveals a band gap of 1.7 eV. Comparisons with a $Sr(Co,Ti)O_x$ alloy and a $(SrCoO_x)_2$:$(SrTiO_3)_1$ superlattice also will also be presented. The obtained results demonstrate artificial superlattices as effective means to defect engineer complex oxides by harnessing the confinement of oxygen vacancies to control the oxygen coordination environment of the transition metal.

Say Young Cook
Department of Materials Science and Engineering, Northwestern University

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