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Electronic and optical properties of La,Cr co-doped $SrTiO_3$ epitaxial thin films[1] RYAN COMES, HONGLIANG ZHANG, YINGGE DU, ROBERT COLBY, MARK BOWDEN, TIMOTHY DROUBAY, SCOTT CHAMBERS, Pacific Northwest Natl Lab — $SrTiO_3$ (STO) is a wide-gap semiconductor well suited for photocatalytic H_2 production due to the alignment of its band edges with the half-cell energies of the H_2O redox reactions. However, the wide optical gap of STO (3.3 eV) makes the material an inefficient light absorber in the visible spectrum, preventing formation of electron-hole pairs needed for photocatalysis. Cr dopants on the Ti site have been shown to reduce the optical bandgap if the Cr ion is in the 3+ state. However, charge conservation in Cr-doped STO dictates that a Cr ion must either be in the 4+ oxidation state or compensate the 3+ state via an oxygen vacancy. In each case, defect electronic states occur, reducing the efficiency of electron-hole pair formation. To compensate this, others have shown that doping STO with La and Cr ions in equal quantities can promote the formation of the Cr^{3+}oxidation state. In this work, we examine the electronic and optical properties of La,Cr-doped STO films grown using oxide molecular beam epitaxy. Films were characterized via *in situ* x-ray photoelectron spectroscopy to measure valence band and core level energies, confirming that most Cr ions are in the 3+ state. Optical absorption measurements show that the optical bandgap is reduced by 0.8 eV from that of undoped STO.

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