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Hole conduction pathways in transparent amorphous tin oxides MATTHEW WAHILA, ZACHARY LEBENS-HIGGINS, NICHOLAS QUACKEN-BUSH, LOUIS PIPER, Dept. of Physics, Binghamton University, KEITH BUT-LER, CHRISTOPHER HENDON, ARON WALSH, Dept. of Chemistry, University of Bath, GRAEME WATSON, School of Chemistry and CRANN, Trinity College Dublin — P-type transparent amorphous oxide semiconductors (TAOS) have yet to be sufficiently demonstrated or commercialized, severely limiting the possible device architecture of transparent and flexible oxide electronics. The lack of p-type amorphous oxide candidates mainly originates from the directional oxygen 2p character of their topmost valence states. Previous attempts to create p-type oxides have involved hybridization of the O 2p with metal orbitals, such as with CuAlO₂ and its Cu 3d - O 2p hybridization. However, the highly directional nature of the utilized orbitals means that structural disorder inhibits hybridization and severely disrupts hole-conduction pathways. Crystalline stannous oxide (SnO) and other lone-pair active post-transition metal oxides can have reduced localization at the valence band edge due to complex hybridization between the O 2p, metal p, and spherical metal s-orbitals. I will discuss our investigation of structural disorder in SnO. Using a combination of synchrotron spectroscopy, and atomistic calculations, our investigation elucidates the important interplay between atomistic and electronic structure in establishing continuous hole conduction pathways at the valence band edge of transparent amorphous oxides.

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