Atomic Layer Deposition of Tunable SnO_2 for Enhanced Stability and Performance in Inverted Perovskite Solar Cells

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The efficiency and long-term stability of inverted (p-i-n) perovskite solar cells strongly depend on the properties of the electron transport layer (ETL).[1,2] Here, we report the fabrication of tunable SnO_2 thin films via atomic layer deposition (ALD),[3] doped with antimony (Sb) to enhance their electrical performance. Sb-doped SnO_2 ETLs were integrated into perovskite devices to systematically investigate their effects on charge extraction, interfacial energetics, and overall device performance, benchmarked against conventional ETLs such as PCBM.[4] we also assessed potential challenges of performing ALD directly on perovskite layers, including surface degradation and defect formation. Our results demonstrate that Sb-doped SnO_2 significantly improves both the conductivity, and the hole mobility compared to standard SnO_2 layer, offering a robust and scalable alternative to organic ETLs. This work provides insights into the rational design of metal oxide ETLs and highlights the potential of ALD-engineered SnO_2 for next-generation high-performance perovskite photovoltaics.

References

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Figures

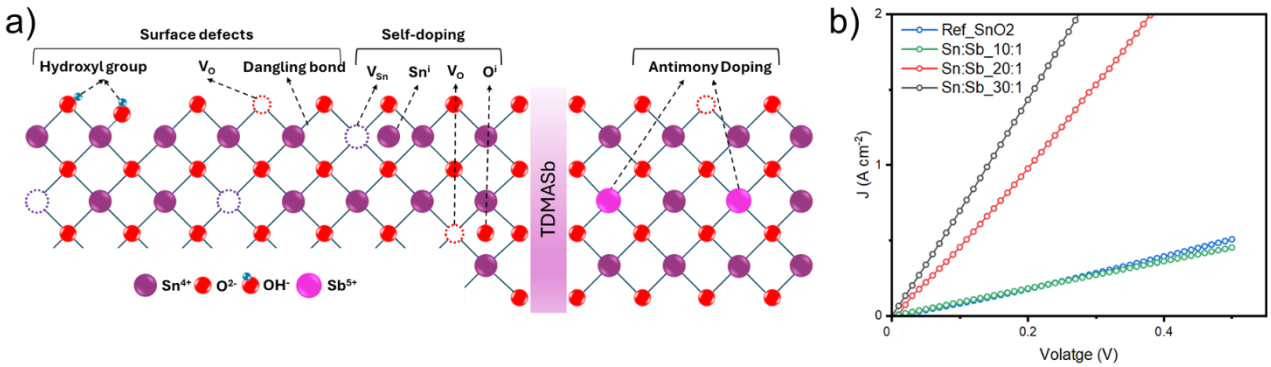

Figure 1: a) Schematic diagram of the tin oxide defects, and b) Dark I-V curves of the conductivity measurements for ITO/SnO_2_Sb/Ag with different Sb ratios.