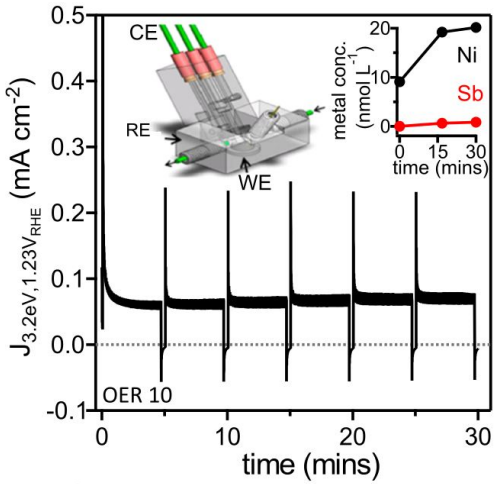
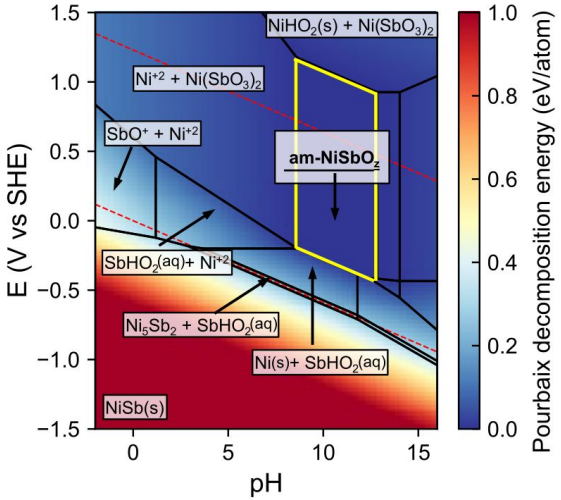
Amorphous nickel antimonate for durable water oxidation

Stable photocurrent may only translate to long-term durability if corrosion is mitigated. The am-$NiSbO_z$ photanode operates with very low dissolved metals concentration.





Computed Pourbaix diagram demonstrates the large stability window (yellow) in pH 9-13 electrolyte.

Scientific Achievement:

An amorphous nickel antimonate photoanode with excellent durability and visible band gap was discovered through integration of high throughput experiments with theory and synchrotron characterization.

Significance and Impact:

The durability challenges in solar-driven water oxidation must be addressed with discovery of operationally stable photoanodes. We harness the corrosion resistance of amorphous materials thus avoiding the formation of an interphase that disrupts the semiconductor-electrolyte junction. Combined with visible photoresponse, am-$NiSbO_x$ embodies a new approach to photoanode development for durable solar fuel generation.

Research Details:

- As an operational photoanode, am-$NiSbO_x$ exhibits the lowest dissolved metals concentration reported to-date.
- X-ray absorption characterization of Ni and Sb establish a structural connection to rutile $NiSb_2O_6$, guiding electronic structure characterization via x-ray photoelectron experiments and density functional theory.

Zhou, L.; Peterson, E. A.; Rao, K. K.; Lu, Y.; Li, X.; Lai, Y.; Bauers, S. R.; Richter, M. H.; Kan, K.; Wang, Y.; Newhouse, P. F.; Yano, J.; Neaton, J. B.; Bajdich, M.; Gregoire, J. M. Addressing Solar Photochemistry Durability with an Amorphous Nickel Antimonate Photoanode. *Cell Reports Physical Science* **2022**, 100959. https://doi.org/10.1016/j.xcrp.2022.100959.

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Supported by the Office of Basic Energy Sciences' Fuels from Sunlight Hub under Award Number DE-SC0021266