Abstract Submitted
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Tin Nitride as an Earth Abundant Photoanode for Water Splitting[1] CHRISTOPHER CASKEY, National Renewable Energy Laboratory, MING MA, Delft University of Technology, VLADAN STEPHANOVIC, STEPHAN LANEY, DAVID GINLEY, National Renewable Energy Laboratory, RYAN RICHARDS, Colorado School of Mines, WILSON SMITH, Delft University of Technology, ANDRIY ZAKUTAYEV, National Renewable Energy Laboratory — Photoelectrochemical (PEC) water splitting–the conversion of water to hydrogen and oxygen using light–is an attractive route to the chemical storage of solar energy. We demonstrate that spinel tin nitride (Sn_3N_4) has conduction and valence bands that straddle the redox potentials of water and we study it as a photoannode material. Sn_3N_4 thin films have been grown on glass at ambient temperature by reactive sputtering of tin in a nitrogen atmosphere. The resulting materials were n-type semiconductors. Carrier concentration, carrier mobility, work function, and optical properties were measured. Results indicate that tin nitride has a band gap of ~ 1.7 eV aligned around water's redox potentials. GW-corrected DFT-surface calculations that take into account water surface dipole interactions are consistent with experiment. Early PEC devices were made from Sn_3N_4 on fluorinated tin oxide with cobalt oxide catalysts and show a small but promising photoresponse (~ 0.1 mA/cm^2 at 1.23 V vs. RHE) under AM 1.5 illumination in 0.1 M potassium phosphate (pH= 7.25). Further work will focus on increasing the photocurrent in tin nitride devices by increasing film quality and identifying the proper catalyst.

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Christopher Caskey
National Renewable Energy Laboratory

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