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Ambient pressure photoelectron spectroscopy studies of photoelectrocatalysts for water splitting and CO2 reduction[1]

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Photoelectrocatalytic water splitting for solar hydrogen production along with photoelectrocatalytic CO2 reduction are potential new technologies that could shift U.S. power consumption away from fossil fuels toward sustainable alternatives, while taking into account the nation's large-scale need for stored chemical fuels. Fundamental information on catalyst surfaces and reaction mechanisms can aid progress in developing these technologies. Ambient pressure photoelectron spectroscopy (APPES) is an excellent technique for providing information on the water/solid interface at a molecular level, with high surface and chemical sensitivity. Here we give an overview of some of our recent APPES studies of water and methanol adsorption and dissociation on GaP, which has been reported to have high faradaic efficiency for methanol generation in pyridine solutions by solar-driven CO2reduction. We also report on our use of APPES to investigate the interactions of adsorbed water and hydroxyl species with pure and Ni-modified CoOOH catalyst surfaces, a type of oxide electrocatalyst shown previously to be active for the oxygen evolution reaction (OER), which plays an essential role in these and many other energy conversion and storage strategies.

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