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Formation of Multiple-Oxide/Hydroxide Species on GaP(111) Surface tracked by Near-Ambient Pressure XPS XUEQIANG ZHANG, Radiation Laboratory Department of Chemistry and Biochemistry, University of Notre Dame, Notre Dame, IN 46556, SYLWIA PTASINSKA, Radiation Laboratory Department of Physics, University of Notre Dame, Notre Dame, IN 46556 — A photoelectrochemical (PEC) solar cell can convert solar energy into chemical energy and store it in the form of hydrogen via water splitting, a promising route to generate sustainable and clean fuels. PEC solar cells consisted of phosphide-based III-V semiconductors have a higher solar to hydrogen (STH) conversion efficiency than other materials. They are, however, usually limited by practical drawbacks such as photocorrosion or decreased electron extraction efficiency due to the formation of surface oxide species. Therefore, it is desirable to understand the interfacial processes of water/O_2 interactions with semiconductors, and to elucidate possible oxidation and reduction mechanisms at the $H_2O(O_2)$/semiconductor interface, especially under near realistic conditions. In this study, $H_2O(O_2)$ dissociative adsorption onto a GaP (111) surface was investigated using near ambient pressure X-ray photoelectron spectroscopy (NAP XPS) at various pressures and temperatures. The interfacial chemistry was tracked by recording high-resolution photoemission spectra of Ga $2p_{3/2}$, O 1s, and P 2p. The formation of Ga and P oxide/hydroxide networks was suggested and a "phase diagram" that demonstrates the distribution of different chemical species under various experimental conditions has been generated.

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