Solid-liquid interfaces studied with synchrotron-based ambient pressure X-ray photoelectron spectroscopy

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Ambient pressure X-ray photoelectron spectroscopy is a valuable tool for investigating surfaces and interfaces in elevated pressure conditions. We have recently constructed and commissioned a new end-station dedicated to Spectroscopic Analysis with Tender X-rays (SpAnTeX) [1]. The SpAnTeX end-station focuses on X-ray photoelectron spectroscopy measurements of buried solid-liquid interfaces, which is facilitated by combining ambient pressure capabilities with the photoelectron kinetic energies accessible with tender X-rays. SpAnTeX can operate at pressures up to 30 mbar and photoelectron kinetic energies up to 10 keV. At the heart of the SpAnTeX end-station is a SPECS PHOIBOS 150 HV NAP electron spectrometer. The spectrometer used at SpAnTeX has two additional features that allow spatially resolved measurements with a resolution better than 30 µm, and time resolved measurements with 100 ns or less resolution. The SpAnTeX end-station is based on a modular concept which allows for the rapid exchange of sample environment modules. To date, we have constructed two modules. One module, the dip-and-pull module, is used for investigating solid-liquid interfaces under applied bias and illumination. The second module incorporates a droplet train and focuses on the investigation of solid-liquid interfacial processes with time resolution ranging from the µs to ms regimes. After a technical introduction to the SpAnTeX end-station and the experimental modules, results obtained using SpAnTeX will be presented. We will highlight studies of solid-liquid interfaces that are of solar energy conversion and environmental importance.

[1] Marco Favaro, Pip C. J. Clark, Michael J. Sear, Martin Johansson, Sven Maehl, Roel van de Krol, David E. Starr, Surface Science, **713**, 121903 (2021).