Scattering fast and dirty: In situ studies of electrochemical growth processes

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Electrochemical deposition and dissolution reactions are of major technological importance in technology, e.g. in microfabrication or energy storage. However, how the atomic scale interface structure influences the growth behavior precisely is still understood only to a very limited extent. Here *in situ* grazing incidence x-ray diffraction and small angle scattering (GIXD, GISAXS) studies of fast electrochemical growth processes at deeply-buried solid-liquid interfaces will be presented. Using the surface diffractometer of beamline ID32 of the ESRF, a dedicated in situ SXS cell,and fast area detectors, these irreversible processes could be studied in one-shot measurements with a time resolution down to 5 ms, enabling studies at growth rates of 11 ML per second, i.e., under technologically relevant conditions. As examples, the homoepitaxial electrochemical deposition and dissolution of Au and Cu single crystal surfaces will be discussed, which reveal a complex mutual influence of the in-plane structure, e.g. surface reconstructions and adsorbed layers, and the growth or dissolution behavior.