PEARL – A New Laboratory for Synchrotron Based Photoelectron Diffraction Experiments at the Swiss Light Source

Matthias Muntwiler[1], Jun Zhang[1], Roland Stania[1,2], Thomas Greber[2], Roman Fasel[3], Philipp Aebi[4], Thomas Jung[1,5], Thilo Glatzel[5], Ernst Meyer[5], Peter Oberta[1], Uwe Flechsig[1], Christoph Quitmann[6], Frithjof Nolting[1]

[1] Paul Scherrer Institut, Switzerland
[2] Universität Zürich, Switzerland
[3] EMPA Swiss Federal Laboratories for Materials Science and Technology, Switzerland
[4] Université de Fribourg, Switzerland
[5] Universität Basel, Switzerland
[6] MAX IV Laboratory, Sweden

The Photo-Emission and Atomic Resolution Laboratory (PEARL) is a new soft X-ray beamline and surface science laboratory at the Swiss Light Source (SLS). PEARL is dedicated to the structural characterization of local bonding geometries of molecular adsorbates on metal or semiconductor surfaces, of nanostructured surfaces, and of surfaces of complex materials with atomic resolution. The main experimental technique is X-ray photoelectron diffraction (XPD/PhD) in angle-scanned and photon energy-scanned mode. Scanning tunneling microscopy (STM) and standard in situ surface preparation facilities complement the XPD facility, and allow beamline users to carefully prepare and characterize their samples on site.

Synchrotron based photoelectron diffraction experiments benefit mainly from tunable photon energy, high photon flux, and polarization. The beamline covers the energy range from 60 eV to 2000 eV, and delivers a maximum photon flux of 10^{11} photons/s/0.1%BW at 800 eV. Flux can be traded for resolution (up to $E/\Delta E \approx 7000$) where chemical states or spin multiplets need to be resolved. The spot size on the sample can be switched between 180 x 60 microns (focused) and 1 x 1 mm (unfocused). The latter can be useful to reduce the flux per unit area on radiation sensitive samples. While the main photon polarization mode at this bending magnet beamline is linear, the beamline can also be operated in (partial) circular polarization mode.

In this contribution, the key features and measured performance data of the beamline and of the experimental station are presented. In addition, first XPD and STM results from test samples demonstrate the capabilities of the new laboratory. The beamline is currently under commissioning and will gradually open for external users in 2015.