

PEEM/XAS beamline at SOLARIS: Status of the commissioning and first results

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PEEM/XAS (Photoemission Electron Microscopy/X-ray Absorption Spectroscopy) beamline [1] is one of the two currently operating beamlines at the Polish synchrotron radiation facility SOLARIS. The beamline is designed for micro-spectroscopic studies of chemical, electronic, structural and magnetic properties by means of XAS combined with XNLD (X-ray natural linear dichroism), XMCD (X-ray magnetic circular dichroism) and XMLD (X-ray magnetic linear dichroism).

The PEEM/XAS beamline for the soft X-ray photon energy range (200-2000 eV) uses a bending magnet as a synchrotron radiation source. The chosen optical design based on the plane grating monochromator working in the collimated light (cPGM) has been optimized by the Optical Group from Elettra. The cPGM is equipped with two gratings to obtain energy resolution ($\Delta E/E$) of 2.5×10^{-4} or better. Experiments may be performed using linear horizontal and variable elliptical polarization of the incident beam.

The beamline is operated in cooperation of several scientific groups, as listed in the authors' affiliations. Two end-stations are available for the microscopy and spectroscopy experiments.

The microscopy XPEEM end-station is a fully equipped ultra-high vacuum (UHV) “surface science laboratory” that comprises a load-lock chamber for fast sample transfer from air, a preparation chamber and the main microscopic chamber. The preparation chamber includes a low energy electron diffraction (LEED) and Auger optics, several evaporation sources, an ion sputtering source and a gas dosing system. The Elmitec PEEM III instrument with a hemispherical electron energy analyzer allows spectro-microscopic and micro-spectroscopic imaging with a magnetic and chemical contrast and spatial resolution of a few tens of nanometers [2].

The XAS end-station is used for purely spectroscopic measurements. It is dedicated to experiments in such fields as material science, physics, chemistry, catalysis and biology. The XAS end-station is a UHV system equipped with two-chambers (one for the spectroscopy and the other for preparation, with possibilities similar to those of the PEEM station). Both bulk and powder samples fitting standard flag-style holders can be measured in an environment from UHV to 10 mbar of He exchange gas, in a broad temperature range (20 – 1300 K) and in an external magnetic field up to 0.2 T.

The present contribution summarizes results of the optics and the end-stations commissioning process. The spatial stability of the source was characterized using X-ray beam position monitors. Small beam instabilities were found and a preliminary feedback system was implemented. The beam parameters, spot size (h x v) and resolution were found of the order of the calculated $100 \times 30 \mu\text{m}^2$ (for the PEEM station) and $5 \cdot 10^{-4}$ values, respectively. Some test results will be presented within this contribution.

The first commissioning phase of the PEEM/XAS beamline has been successfully completed and the beamline is ready to host first users. The beamline is also available for user as a part of CERIC-ERIC infrastructure [3].

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[1] http://www.synchrotron.uj.edu.pl/en_GB/linia-peem/xas

[2] M. Ślęzak et al., X-Ray Spectrom. 44 (2015) 317–322

[3] <http://ceric-eric.eu/index.php?n=Users.Homepage>