Research capabilities of the DEMETER experimental line at the NSRC SOLARIS facility

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DEMETER (Dual Electron Microscopy and Spectroscopy Beamline) is soft X-rays beamline dedicated for both surface and environmental studies. The versatility of the DEMETER beamline allows to carried out the research in ultra-high vacuum conditions and in environmental conditions, thanks to implementation of the two different X-ray microscopes installed at two independent branches. One of the end stations is the PEEM microscope (Photoemission Electron Microscope), which is very powerful tool to study chemical, magnetic and electronic properties of surfaces, thin films and interfaces [1]. Tunable x-ray source in combination with the energy analyzer at PEEM end-station offer a wide range of other surface sensitive techniques such as XAS, XPS, ARPES or XPD.

PEEM microscope offers additional equipment enabling in-situ sample preparation. The availability of a whole range of spectroscopic techniques combined with in-situ preparation, makes it a very useful tool among the SOLARIS synchrotron user community. Spatial resolution in the PEEM microscope reaches the nanometer scale.

The second branch of the DEMETER beamline is the STXM microscope (Scanning Transmission X-ray Microscope). The STXM microscope is, so far, the only X-ray transmission microscope in Poland. The end-station is designed to study environmental samples (in air or He atmosphere). Spatial resolution in STXM depends on the quality of the Fresnel lens, which is the most important optical element and in this case it reaches 25 nm. The main advantage of this tool is the combination of microscopy and spectroscopy within one technique [2]. Depending on the user's needs, it is possible to extend the research capabilities of the STXM microscope with a ptychography or electrochemical cell for in-situ catalytic reactions. The source is an elliptically polarized undulator which provides high photon flux (10^{12}ph/s/%) and covering the energy range from 100-2000 eV. The design and performance of PEEM and STXM microscopes will be described in the presentation.

[1]. W. Janus, T. Ślezak *et al*., Scientific Reports, **13**, 4824 (2023).

[2]. P. Błaszczak, A. Ducka *et al*., Journal of the European Ceramic Society, **2**, 438 (2023).