

Tender XAS Beamline at SOLARIS Synchrotron - ASTRA: Overview

Monday, November 4, 2024 11:15 AM (20 minutes)

The ASTRA beamline at the SOLARIS synchrotron (Krakow, Poland) is a relatively new bending magnet beamline, having been open for user operation for just 14 months. As suggested by its name (ASTRA - "Absorption Spectroscopy beamline for Tender energy Range and Above"), it is an X-ray absorption spectroscopy (XAS) beamline. The photon energy range covered by ASTRA extends from 1 to 15 keV, including the tender and part of the hard X-ray energy range. The white beam is monochromatized by a modified Lemonnier type double crystal monochromator (DCM) operating under high vacuum conditions, which can be equipped with different types of crystals to cover the working energy range. XAS spectra are recorded in both transmission and fluorescence modes. The beamline is equipped with an X-ray camera, facilitating precise sample positioning for XAS. Measurements are controlled by the specially developed program AstraLibra, which features a user-friendly interface and advanced functionalities.

ASTRA is a reconfigurable beamline designed to study a wide range of samples within dynamic environments. For example, the beamline enables researchers to investigate microstructural changes that occur during the charging and discharging of batteries, utilizing XANES spectroscopy in transmission mode within both the hard and tender energy ranges. Additionally, ASTRA's users have successfully conducted in-situ experiments in the tender energy range at elevated temperatures with gas flow, providing critical insights into material behaviours under realistic operating conditions. The beamline is equipped with specialized cells designed for measuring samples in liquid phases, making it ideal for both in-situ and operando studies. This capability has been successfully demonstrated, highlighting ASTRA's significant contribution to advancing research in material sciences and related fields.

Moreover, the implementation of a combination of XAS and Raman spectroscopy at the ASTRA beamline is in commissioning. This development will enable researchers to record XAS and Raman spectra simultaneously, providing a possibility for comprehensive material analysis. Once operational, this combined capability will significantly enhance the scope and depth of research that can be conducted, particularly in studying complex processes and materials under operating conditions in the tender energy range. During the presentation, technical aspects of the beamline will be discussed, and selected results of ex-situ and in-situ experiments will be presented.

Acknowledgements: The development of the ASTRA beamline was partly supported within the grant, Innovative Hochschule –Leuchtturm NR - Aus der Höhe in die Breite“(03-IHS-084) by the Federal Ministry of Education and Research, Germany and within the EU Horizon 2020 programme (952148-Sylinda).

Type of presence

Presence online

Primary authors: Dr MAXIMENKO, Alexey (National Synchrotron Radiation Centre SOLARIS Jagiellonian University, Kraków, 31-007, Poland); Dr ALLUHAIBI, Lulu (National Synchrotron Radiation Centre SOLARIS Jagiellonian University, Kraków, 31-007, Poland); GAZDOWICZ, Grzegorz (National Synchrotron Radiation Centre SOLARIS Jagiellonian University, Kraków, 31-007, Poland); ZALKA, Dora (National Synchrotron Radiation Centre SOLARIS Jagiellonian University, Kraków, 31-007, Poland); BRZYSKI, Marcin (National Synchrotron Radiation Centre SOLARIS Jagiellonian University, Kraków, 31-007, Poland); PISZAK, Marcel (National Synchrotron Radiation Centre SOLARIS Jagiellonian University, Kraków, 31-007, Poland); LICHTENBERG, Henning (National Synchrotron Radiation Centre SOLARIS Jagiellonian University, Kraków, 31-007, Poland); Prof. HORMES, Josef (University of Bonn, Bonn, 53113, Germany); Prof. PRANGE, Alexander (Hochschule Niederrhein University of Applied Sciences, Krefeld, 47805, Germany)

Presenter: Dr MAXIMENKO, Alexey (National Synchrotron Radiation Centre SOLARIS Jagiellonian University, Kraków, 31-007, Poland)

Session Classification: Unifying Efforts: Developing the Ukrainian Synchrotron Community and Research Infrastructure

