Performance of the QEXAFS setup at the undulator beamline P64 at PETRA III

B. Bornmann[(1)], J. Kläs[(1)], O. Müller[(2)], R. Wagner[(1)], D. Lützenkirchen-Hecht[(1)] and R. Frahm[(1)]
[(1)] University of Wuppertal, Faculty 4 – Physics, 42097 Wuppertal, Germany
[(2)] SSRL, 2575 Sand Hill Road, Menlo Park, CA 94025, USA
bornmann@uni-wuppertal.de

Introduction

The undulator beamline P64 at the high brillance synchrotron source PETRA III (DESY, Germany) started user operation in spring 2017. One of its outstanding features is a dedicated cryo-cooled monochromator for quick scanning EXAFS (QEXAFS) [1, 2] with a time resolution down to 10 ms. This system and its capabilities will be presented in detail, and its performance and results of the very first user experiments will be shown.

Experimental Methods

The setup is dedicated to perform XAFS scans with a repetition rate of up to 100 Hz. Channel-cut Si-(111) and Si-(311) crystals are installed on an oscillating stage driven by a direct drive torque motor inside of a goniometer, covering X-ray energies from 4.5 keV to 44 keV. The beamline offers optional focusing with cylindrical mirrors. In the experimental hutch gridded ionization chambers and fast current amplifiers with rise times of a few microseconds [3] are installed which allow to resolve high quality XAFS spectra even at these high repetition rates. Lately, capable setups for fluorescence detection with a PIPS detector and a goniometer for reflectivity measurements have been added. The data acquisition is accomplished with a dedicated software and NI hardware with sampling rates of up to 2 MHz. Data analysis is performed with newly developed software to handle the large amounts of data, which are typically collected in experiments lasting up to a few hours.

Results and Discussion

First user experiments included in-situ and operando catalysis as well as surface sensitive measurements of the reduction of heated steel surfaces for brazing applications beside others. The results, performance and limiting factors of the QEXAFS system will be discussed.

Conclusions

After the commissioning of the beamline first user experiments with the QEXAFS setup at P64 have been performed successfully. The setup is improved continuously and open for beamtime application.

Supported by BMBF, grant numbers 05K13PX1 and 05K10PX1.

[1] O. Müller, D. Lützenkirchen-Hecht and R. Frahm, Rev. Sci. Inst. 86, 093905 (2015).
[2] O. Müller, M. Nachtegaal, J. Just, D. Lützenkirchen-Hecht and R. Frahm, J. Synchrotron Rad. 23, 260 (2016).
[3] O. Müller, J. Stötzel, D. Lützenkirchen-Hecht and R Frahm, J. Phys.: Conf. Ser. 425, 092010 (2013).