MS042.O02

X-ray Raman scattering spectroscopy at the ESRF

Christoph J. Sahle[1]
[1]*ESRF - The European Synchtrotron, Grenoble, France*
E-mail: christoph.sahle@esrf.fr

X-ray Raman scattering (XRS) is non-resonant inelastic x-ray scattering from core electrons, i.e. XRS gives access to soft X-ray absorption edges or, similarly, electron energy loss spectra, using hard X-rays as probe [1]. Thus, XRS is an emerging technique with a rapidly growing user community that allows us to measure absorption edges of low-Z elements of samples contained in complicated in-situ sample environments, such as high-pressure diamond anvil cells and in-situ reactors [2,3]. The eminent increase in popularity for this technique is not least due to the emergence of new instruments at 3rd generation synchrotron light sources that are solely dedicated for XRS experiments. Beamline ID20 of the ESRF hosts one of these dedicated XRS spectrometers [4] and in this contribution, I will give an introductory overview of this pioneering instrument and present first results obtained using it. Concretely, we will explore the capabilities of using XRS in high-pressure studies and studies aiming at disentangling complicated reaction pathways in energy materials [5]. Furthermore, we will glance at how to use the spatially resolved information obtained using the unique setup of ID20 to construct fundamentally new tomographic images in which the inelastic X-ray scattering signal is used as contrast for the three-dimensional representations. These studies highlight the potential of XRS spectroscopy for the study of local atomic structure and bonding topology of disordered matter under extreme conditions as well as in-situ chemistry.

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Keywords: XRS, extreme conditions, electronic structure