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Materials Research at CONRAD-2/HZB: Recent Developments and Outlook

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In recent years, the rapid development of neutron imaging methods by the operators of neutron sources and their users has triggered a tremendous improvement of both spatial and time resolution and furthermore the implementation of techniques that utilise new contrast mechanisms. Such developments have now become standard methods for many research fields in materials science. The range of current and potential applications is broad, including general materials research –with a particular emphasis on the area of materials and systems related to the generation and use of renewable energy –but also examples from biology, palaeontology, and cultural heritage and specific engineering materials. One important catalyst for the further improvement of neutron imaging techniques is the rapidly increasing demand for non-destructive and non-invasive in-situ and operando investigations of materials and devices that are used for energy supply, such as batteries and fuel cells. Here, the properties and the operation characteristics of the related materials and devices are often closely connected to the distribution and movement of light elements such as lithium and hydrogen. Due to their intrinsic properties, neutrons penetrate deeply into most common metallic materials while they have a high sensitivity to light elements such as hydrogen, hydrogenous substances or lithium. This makes neutrons perfectly suited probes for research on materials that are used for energy storage and conversion. In this contribution an overview to recent developments and activities at the CONRAD-2/V7 facility at Helmholtz Centre Berlin (HZB) will be provided. Technical developments on various fields will be presented, e.g. methods based on Bragg-edge imaging and dual-mode imaging, and data quantification techniques. Applications on energy-related materials research, employing in-situ techniques will be shown. Finally an outlook on the future of these activities at Helmholtz Centre Berlin will be provided.

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