Contribution ID: **115** Type: **not specified**

Neutron imaging of electrochemical energy converters

Tuesday 29 October 2019 16:00 (20 minutes)

To address climate change, air pollution and other environmental issues, as well as our critical dependence on fossil fuels, a profound transformation of the energy landscape is required. This transformation has already begun, at least in given countries, with the rapidly increasing share of renewables in electricity production, as well as the growing popularity of electrification in mobility. However, important challenges remain, such as the long term storage of electrical energy. Electrochemical energy converters can play a significant role in solving this issue, as they build a bridge between the renewable production in form of electricity and the low cost storage in form of hydrogen.
Here, different challenges faced in the understanding of electrochemical systems (fuel cells, electrolysers and batteries) will be presented. The way neutron imaging has been used in the past –at PSI and elsewhere –to address these challenges will be discussed, as well as the applications made possible by advanced measurement modalities such as dark field and energy selective imaging. A particular attention will be given to the opportunities opened by the sensitivity of the cross section to molecular motions of hydrogen compounds, in relation with the inelastic scattering of neutrons: this effect has already been used to distinguish between liquid water and ice, and several further possibilities can be considered. Finally, the possibilities of collaborations within the neutron scattering community in the analysis of imaging measurements with advanced modalities will be discussed.

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Session Classification: Contributed talks

Track Classification: Oral presentation