

Neutron scattering and electrochemistry: European Spallation Source sample environment for electrochemistry

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The European Spallation Source (ESS) is one of the largest science and technology infrastructure projects being built today¹. Because of the ability of the neutron to distinguish between small atoms as Lithium, Hydrogen, and between isotopes, neutron scattering is an essential tool to analyse, understand and develop electrochemical systems. However, performing neutron scattering experiments brings some constraints to the sample and the cells: The cell material shall be compatible to neutron and have a homogeneous and reproducible background. Usually, the sample quantity has to be larger for neutron than for X-ray experiments. In addition to the requirements given by the neutron experiment, the ones for electrochemistry have to be added, such as the good contact between the electrode and the sample, the connection of the electrodes etc.

Thanks to the high flux at the spallation source ESS, some of the limitations that previously existed will be easier to overcome. We, the softmatter and chemistry sample environment team (SCSE) at ESS have developed two cells suitable for neutron experiments in collaboration with Tartu University. One is a versatile cell that can be used for inelastic and diffraction measurement for the study of new materials such as solid electrolytes but also batteries. The possibility to have 2 to 3 electrodes gives the cell the advantage to be used for different types of experiment. A second cell for battery applications based on the design from Godbole et al.² was developed to measure coin cell and half cells and to observe the structural change in lithium.

The two cells contribute to the pool of sample environment equipment at ESS and make in situ and in operando measurement on different ESS instruments possible. In addition to the cells, the Chemistry and Life Science Support group at ESS will provide access to appropriate laboratories for the user to perform electrochemistry experiments, to prepare the sample and to assemble the cells.

In the poster, we present the equipment already available at ESS to perform electrochemical experiments from the laboratory to the instrument, including the first version of the battery and electrochemical cells, and will show the future needs and potential for developments.

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Enerli Monerjan, Pirert Pikma and Rasmus Palm

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