



Contribution ID: 48

Type: Oral Presentation

## The Quest for Sustainable and Circular Battery Technologies - Operando X-ray Techniques probing Dynamic Processes in Batteries

Wednesday, November 29, 2023 11:20 AM (30 minutes)

Batteries are of key importance in the energy transition, i.e. for mobility as well as for a temporary (intermediate) storage of excess energy (e.g. stabilise the grid). Li ion batteries are widely used in applications such as mobile phones and laptops, and will likely be key to future electromobility due to their low weight. Alternatively, more sustainable batteries are essential to enable the significant increase in demand as well as their differing applications and requirements (incl. local and grid storage), while reducing pressure on climate and environment.

Rational design of novel battery chemistries and technologies requires a detailed understanding of the charge, discharge and deactivation mechanisms, preferably quantitative and spatially resolved. X-ray techniques (spectroscopy and scattering (XAS and XRD)) are characterisation techniques which provide detailed structural and electronic information on the material under investigation, in a time- and spatially resolved manner. These operando spectro-electrochemical investigations [1] provide insights in the type, location and reversibility of the intermediates formed in and on electrodes and/or electrolytes as a function of state-of-charge and position in the battery. Obtained insights in cycling and deactivation mechanisms for different battery types, i.e. Li-ion and Li-S [1-6] as well as more sustainable battery technologies like Ni-Fe and Fe-air, will be discussed.

[1] Y. Gorlin, A. Siebel, M. Piana, T. Huthwelker, H. Jha, G. Monsch, F. Kraus, H.A. Gasteiger, M. Tromp, J. Electrochem. Soc. 162(7): A1146-A1155, 2015.

[2] Y. Gorlin, M. U. M. Patel, A. Freiberg, Q. He, M. Piana, M. Tromp, H. A. Gasteiger, J. Electrochem. Soc. 2016, 163(6), A930-A939.

[3] J. Wandt, A. Freiberg, R. Thomas, Y. Gorlin, A. Siebel, R. Jung, H. A. Gasteiger, M. Tromp, J. Mater. Chem. A 2016, 4, 18300-18305.

[4] A. T. S. Freiberg, A. Siebel, A. Berger, S. M. Webb, Y. Gorlin, H. A. Gasteiger, M. Tromp, J. Phys. Chem. C 2018, 122, 10, 5303-5316.

[5] A. Berger, A. T. S. Freiberg, R. J. Thomas, M. U. M. Patel, M. Tromp, H. Gasteiger, Y. Gorlin, J. Electrochem. Soc. 2018, 165(7), A1288-A1296.

[6] R. Jung, F. Linsenmann, R. J. Thomas, J. Wandt, S. Solchenbach, F. Maglia, C. Stinner, H. A. Gasteiger, M. Tromp, J. Electrochem. Soc. 2019, 166(2): A378-A389.

**Primary author:** Prof. TROMP, Moniek (University of Groningen, Zernike Institute for Advanced Materials)

**Presenter:** Prof. TROMP, Moniek (University of Groningen, Zernike Institute for Advanced Materials)