## MS42-P12 | OPERATIONAL NON-UNIFORMITIES OF LITHIUM DISTRIBUTION IN LI-ION BATTERIES PROBED BY DIFFRACTION TECHNIQUES

Senyshyn, Anatoliy (Technische Univesität München, Garching bei München, GER)

Energy storage devices based on different technologies have gained in relevance for a wide range of applications from supplying portable devices to large electric vehicles. The lithium-based energy storage technology dominates to the market due to the best compromise between energy and power densities, low self-discharge when not in use, tiny memory effect *etc*.

Modern Li-ion batteries are sophisticated electrochemical devices, where numerous degrees of freedom (either chemical, morphological or transport) are combined with complicated geometries of the electrode integration. The understanding of processes supplementing the cell operation, fatigue and abuse requires new dedicated experimental techniques capable to reveal “live” information. In this instance the use of diffraction techniques in combination with electrochemical studies has been found well-suited for *in situ* and *in operando* characterization of electrochemical energy storage systems.

Operation of typical Li-ion cell is supplemented by the development of spatial inhomogeneities of current, lithium and/or electrolyte distribution (often difficult to quantify), but surely affecting performance, cycling stability and safety. The problem of cell non-uniformity (indirectly pointed by electrochemical measurements) and its effect is quite poorly accounted in literature. In the current contribution a combination of spatially-resolved neutron powder diffraction [1] and powder diffraction using high-energy photon beams (X-ray diffraction radiography [2] and tomography) applied *in situ* for studies on commercial Li-ion cells of prismatic- and 18650-type will be presented.

[1] M.J.Mühlbauer, O. Dolotko, M.Hofmann et al., J. Power Sources 348 (2017) 145-149
[2] M.J. Mühlbauer, A. Schökel, M. Etter et al., J. Power Sources 403 (2018) 49-55