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Structured graphite anodes for Li-ion batteries

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Laser structured electrodes for Li-ion batteries have been reported as a promising approach for improvement of battery performance. The contact area between the electrolyte and active material in the electrode can be modified as a result of the three-dimensional structured electrode surface. The effective Li-ion diffusion pathways are shortened during the charging and discharging of the cell. Surface structuring can potentially reduce cell internal resistance, which has a positive impact on the battery performance at high C-rates. In this work, electrochemical properties of the laser structured and unstructured graphite anodes in fresh and aged NMC/C cells were studied. The aim was to examine cell performance at high C-rates. NMC/C pouch cells were studied via in-situ neutron diffraction, an important method for characterizing the structural changes before/after the intercalation of Li into graphite. It has been confirmed that the electrochemical performance of the laser structured electrodes has been improved and that there are no structural changes present in the active material caused by laser irradiation. These results bring many insights for our future work in the area of structured 3D electrodes. One possibility to shorten the ion diffusion paths in the battery cells is by preparing the electrodes using additive manufacturing. This method offers many opportunities for innovative electrode and cell design, thanks to its high precision and diversity.

Primary authors: PIVARNÍKOVÁ, Ivana (Technical University of Munich, Heinz Maier-Leibnitz Zentrum (MLZ)); PAUL, Neelima (Technical University of Munich, Heinz Maier-Leibnitz Zentrum (MLZ)); HABEDANK, Jan (Technical University of Munich, Institute for Machine Tools and Industrial Management); KRAFT, Ludwig (Technical University of Munich, Institute for Electrical Energy Storage Technology); BARAN, Volodymyr; Prof. JOSSEN, Andreas (Technical University of Munich, Institute for Electrical Energy Storage Technology); Prof. REINHART, Gunther (Technical University of Munich, Institute for Machine Tools and Industrial Management); Prof. MÜLLER-BUSCHBAUM, Peter (TU München, Physik-Department, LS Funktionelle Materialien); GILLES, Ralph (Technical University of Munich, Heinz Maier-Leibnitz Zentrum (MLZ))

Presenter: PIVARNÍKOVÁ, Ivana (Technical University of Munich, Heinz Maier-Leibnitz Zentrum (MLZ))

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