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Electrolyte Motion Induced Salt Inhomogeneity in Large- Format Lithium-Ions Cells –Implications for Cell Lifetime and Performance

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In 2023, the Dalhousie group demonstrated that expansion of active materials causes electrolyte flow in cylindrical cells upon cell cycling. We show that this electrolyte motion can cause severe inhomogeneity in the spatial distribution of conducting salt inside the jelly roll/stack in cylindrical cells and also in prismatic lithium-ion cells under high compression. This novel mechanism -which we termed „electrolyte motion induced salt inhomogeneity"(EMSI) –has a very strong impact on cell lifetime and performance, especially when applying high charge or discharge currents.
We present 1) experimental data on the build-up of the LiPF6 salt gradient (and a novel and simple experimental approach for measuring this gradient), 2) a consistent mechanistic explanation, 3) 3D simulation with coupling of electrochemistry and fluid-dynamics and 4) a discussion on the implications of this novel ageing mechanism and possible applications of neutron imaging/ diffraction in this respect.

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