Polymeric backbone eutectogel hybrid solid-state electrolytes for lithium-ion batteries

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The need for sustainable mobility leads to a growth of the market of electric cars. At this moment, lithium ion batteries are the most suitable technology due to their high gravimetric and volumetric energy density. In all roadmaps for battery development, solid state batteries are the next step after advanced lithium ion batteries. They offer the potential to significantly increase the energy density, combined with a higher safety due to the absence of a flammable liquid electrolyte. During the last years, research on solid state batteries has significantly increased, but still faces many challenges, such as the development of a high performant solid electrolyte, the integration of the cathode active material with the solid electrolyte, and the integration of the lithium metal anode with is needed to obtain the predefined energy densities.

The polymeric backbone eutectogel (P-ETG) is a hybrid solid-state electrolyte in which a Li-ion conducting deep eutectic solvent is confined within the polymeric backbone. Such an electrolyte allows the combination of the processability advantage of polymers with the high Li-ion conductivity of liquid electrolytes, thus overcoming primary disadvantages of solid polymer electrolytes. To obtain insights into the interaction between the deep eutectic solvent and the polymeric backbone, different compositions of P-ETGs are synthesized and studied by means of electrochemical and physico-chemical characterization techniques. The chemical compatibility between the cathode and electrolyte is studied by means of (physico)chemical characterization methods, such as XRD, FT-IR, and ICP-OES. The galvanostatic cycling behaviour of the Li|P-ETG|NMC-622 cell is assessed at several (dis)charge rates.

This project receives financial support from VLAIO (Baekeland project) and Umicore.

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