Solid State Battery Cathodes

This technology offers mixed conductive interphases for solid state batteries without the issues of ceramic cathodes. The system is thin, percolative, and can be formed in-situ by a low-melting-point sintering additive with a ten-times and three-times area capacity improvement over the state-of-the-art cathodes.

What is the Problem?

What is the problem?

Solid-state batteries (SSBs) could significantly improve safety and energy density over the liquid cells. One key enabling technology is the high energy all ceramic cathodes. NASICON-type LATP is considered as one of the most attractive solid-state electrolytes on the cathode side due to its high oxidation potential and high ionic conductivity. The usage, however, is limited by its large interfacial resistances against most of the cathode materials, due to the chemical potential incompatibility as well as the thermodynamic instability during high temperature sintering that is usually needed to achieve high mass density. These issues have limited the progression of this technology.

What is the Solution?

The solution is a thin, percolative, and mixed conductive interphase that can be formed in-situ by a low-melting-point sintering additive. These mixed conductive interphases drastically improve lithium kinetics, allowing for high-loading solid LATP/LiCoO2 cathodes up to ~ 6 mAh cm-2. The technique is also applicable to Ni-rich cathode materials, achieving up to ~ 10 mAh cm-2, which is expected to enable high energy density in SSBs. Coupled with oxide and sulfide solid state electrolytes, composite cathodes show a ten-times and three-times area capacity improvement respectively over the state-of-the-art cathodes.

What is the Competitive Advantage?

Solid state battery development has been hindered by issues with high energy all ceramic cathodes, due to the large interfacial resistances. This has led to continued use of liquid cells. This solution is enabling for solid state batteries, as it can drastically increase area capacity while mitigating the issues of ceramic cathodes.

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Category

Selection of Available Technologies
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