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Lowering the operational temperature of all-solid-state lithium polymer cell with highly conductive and interfacially robust solid polymer electrolytes

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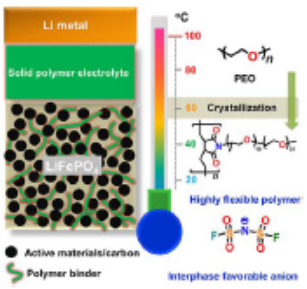
HIGHLIGHTS

- Super soft solid polymer electrolyte (SPE) with $Li[N(SO_2F)_2]$ is prepared.
- The prepared SPE is highly conductive at ambient temperature.
- The prepared SPE has good electrochemical compatibility with Li metal electrode.
- Li | $LiFePO_4$ cell using the prepared SPE can be cycled at ambient temperature.

GRAPHICAL ABSTRACT



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ABSTRACT

Novel solid polymer electrolytes (SPEs), comprising of comb polymer matrix grafted with soft and disordered polyether moieties (Jeffamine®) and lithium bis(fluorosulfonyl)imide (LiFSI) are investigated in all-solid-state lithium metal (Li^+) polymer cells. The LiFSI/Jeffamine-based SPEs are fully amorphous at room temperature with glass transitions as low as ca. −55 °C. They show higher ionic conductivities than conventional poly(ethylene oxide) (PEO)-based SPEs at ambient temperature region, and good electrochemical compatibility with Li^+ electrode. These exceptional properties enable the operational temperature of Li^+ | $LiFePO_4$ cells to be decreased from an elevated temperature (70 °C) to room temperature. Those results suggest that LiFSI/Jeffamine-based SPEs can be promising electrolyte candidates for developing safe and high performance all-solid-state Li^+ batteries.

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