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Improvement of the Cationic Transport in Polymer Electrolytes with (Difluoromethanesulfonyl)(trifluoromethanesulfonyl)imide Salts

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Abstract

Solid polymer electrolytes (SPEs) with high cationic conductivity are highly desired for enhancing the power performance of all-solid-state alkali metal batteries (ASSAMBs). In this work, a new sulfonimide anion, (difluoromethanesulfonyl)(trifluoromethanesulfonyl)imide ($DFTFSI^-$), is proposed as a possible alternative to the most widely used bis(trifluoromethanesulfonyl)imide anion ($TFSI^-$) for attaining higher cationically conductive SPEs. Our results show that DFTFSI-based alkali metal salts maintain the merits of TFSI-based ones (e. g. good chemical and thermal stability as well as structural flexibility). The hydrogen-bond interaction between $DFTFSI^-$ and poly(ethylene oxide) effectively enhances the cationic conductivity of DFTFSI-based SPEs at a low expense of total ionic conductivity. In addition to the promising application of DFTFSI-based SPEs in ASSAMBs, this work also reveals that customizing the chemical structure of anions with the consideration of the properties of polymer matrices is of utmost importance for accessing robust SPEs in the future.

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