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# Binary Molten Salt Systems Using Ether Functionalized Li-Salts

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Molten salts and ionic liquids (ILs) have emerged as highly promising electrolytic media for lithium-ion batteries (LIBs), offering several advantages that contribute to enhanced battery performance, efficiency, and sustainability. Their distinctive physicochemical properties and high Li transference number facilitates greater current densities during operation, thereby improving charge-discharge performance compared to conventional organic solvent-based electrolytes[1]. Despite these advantages, molten lithium salts often suffer from significantly high viscosities relative to their organic solvent counterparts, hindering ion transport and limiting their practical use as effective electrolytes in LIBs. One key factor influencing the viscosity of ILs is the conformational flexibility of the constituent salts. A well-studied example is the weakly coordinating anion bis(trifluoromethanesulfonyl)imide (TFSI), which exhibits low viscosity due to the low rotational barriers around the S–N bonds, allowing considerable conformational freedom[2]. Recent studies show that introducing ether groups into lithium salts enhances their dissociation, increasing free lithium cation concentration. This reduces viscosity and melting points, making ether-functionalized lithium salts promising for advanced LIB applications[3]. In this study, we report the synthesis and characterization of asymmetric lithium imide salts incorporating flexible oligoether side chains to reduce viscosity and melting point. The synthesized compounds, $Li[(CF_3SO_2NSO_2R)]$ (R = ether chains), feature sulfonyl and oligoether moieties tailored to improve electrolyte performance. We evaluated their electrochemical stability, viscosity, and ion transport characteristics, and further explored binary electrolyte systems where the synthesized ether-functionalized lithium salts were used as co-salts or additives to commercially available lithium salts such as LiFSI and LiTFSI. Our findings demonstrate that the mixed electrolyte systems exhibit improved ionic conductivity, thereby overcoming the viscosity-related limitations commonly observed in molten Li salt electrolytes.

## References

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I am Md. Sharif Hossain, an assistant professor in the Department of Chemistry and Life Sciences at Yokohama National University, Japan. My expertise lies in synthetic organic chemistry, photocatalysis and lithium-ion battery applications. I earned my Ph.D. from Utsunomiya University, Japan in 2020 under a MEXT scholarship. I then worked as a postdoctoral researcher at Utsunomiya University and later at Kyushu University's I$^2$CNER, where I conducted research on visible-light-driven photocatalysis for hydrogen production.