Highly-Fluorinated, High-Performance Electrolytes For Lithium Batteries and Other Electrochemical Devices

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Polyfluorinated alkoxides (X^-) and unsymmetrical dialkoxides ($X–Y^{2-}$) with formulas $OC(CF_3)_{3–n}R_n^-$ and $o\text{-}C_6H_{4–n}F_nO(C(CF_3)_2O)^{2-}$ have been used to prepare more than 30 lithium salts of BX_4^-, AlX_4^-, $B(X–Y)_2^-$, and $Al(X–Y)_2^-$ anions (R = H, alkyl, aryl, or substituted alkyl or aryl). Most of the compounds investigated have the formula $LiAlX_4$ or $LiB(X–Y)_2^-$, and most of these have DME solution conductivites at least 50 times greater than an equal concentration of $LiCF_3SO_3$. The synthesis of several new fluoroalcohols will be discussed briefly. The syntheses, structures, and thermal and hydrolytic stabilities of the lithium salts will be discussed in detail, as will a variety of electrochemical properties of their solutions in polar solvents, including conductivities as a function of solvent, electrolyte concentration, and the addition of 12-crown-4, anodic and cathodic stabilities, and the promotion, of lack thereof, of anodic aluminum corrosion.