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Fluorescence quenching and diffusion within Li salt added ionic liquid media

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In the fast-growing world with the ever-increasing need for alternative solvents, ionic liquids are being explored widely in almost all areas of chemistry. Ionic liquids are room-temperature molten salts, composed of ions with notable physicochemical properties, such as, good thermal stability, high solubility, negligible vapor pressure, and non-flammability, among others. In the current energy scenario, lithium-ion batteries have proven to be a promising choice for mobile applications. But to expand its applications to large-scale, we have to cope-up with some of the limitations. Thermal stability is a major issue in the currently used electrolytes, in lithium ion batteries. While the organic solvents had their own limitations, ionic liquids, because of their desirable properties, have drawn much attention from researchers as alternative electrolytes for lithium-ion batteries. To further develop and improve this new alternative class of (ionic liquid + Li salt) electrolyte system for industrial and commercial purpose, knowledge of diffusion within such systems is of utmost importance. We present a detailed investigation of fluorescence quenching of a model solute pyrene by an electron/charge acceptor quenching agent nitromethane dissolved in [1-ethyl-3-methylimidazolium bis(trifluoromethyl sulfonyl)imide ([emim][Tf₂N]) + lithium bis(trifluoromethyl sulfonyl) imide (LiTf₂N)] mixtures in the temperature range (298.15 to 358.15)K. Various equilibrium quenching constants as well as bimolecular quenching rate constants are obtained and related to the diffusion behavior within ([emim][Tf₂N] + LiTf₂N) system. The result is correlated with the results from fluorescence correlation spectroscopy using a different probe. Details of diffusion behavior showing versatility of (ionic liquid + Li salt) systems are established.

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