SULFOLANE AS AN APROTIC SOLVENT

Zuzana Štichová, Marie Sedlaříková, Jiří Vondrák

Faculty of Electrical Engineering, Department of Electrotechnology, Brno 61600, Czech Republic
E-mail: vondralj@feec.vutbr.cz

Sulfolane was tested as a potential solvent for electrochemistry in aprotic systems.

Its fairly high freezing point (over 28°C) can be lowered by addition of another polar aprotic solvent. Therefore, the conductivity, freezing point, permittivity and viscosity of sulfolane itself and its mixtures with other aprotic solvents (propylene carbonate, ethylene carbonate, dimethylcarbonate, dimethylsulfoxide) were measured. Due to extremely high cryoscopic constant caused by unusual value of enthalpy of melting, any additive can lower the freezing point even below 0°C. Unfortunately, the viscosity of sulfolane at low temperatures is fairly high. Therefore, also the conductivity of lithium salt solutions is low. Therefore, viscosity and conductivity were measured for solutions of LiClO₄ in pure sulfolane and in mixtures sulfolane – propylene carbonate (1:1).

The Walden rule connecting viscosity η and conductivity σ and be written in a modified form [1] as η . σ⁻ᵃ = const where the exponent a approximately equals to 0.7 The value of the slope a was evaluated from a logarithmic plot. However, the viscosity for the same conductivity is by 20 % higher for pure sulfolane solution. The data were obtained between +20 and +60°C in a solution of 0.5 M LiClO₄.

Basic properties of sulfolane for electrolyte preparation were described in [2]. The authors described an experimental lithium cell. However, the charge efficiency of lithium electrode did not exceed 75%. On the other hand, metallic lithium preserved its metallic luster in sulfolane for more than one month in dry atmosphere.

Most important results were obtained with sulfolane at temperature below its melting point show marked increase of viscosity, which becomes even stronger in the presence of lithium salts.

Measurements of dielectric properties confirm the extraordinary behavior of a liquid below the melting point of the solvent.

Finally, the presence of sulfolane causes an important rise of the flash point temperature, thus making the application of organic solvents safer.

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References