Electrochemical Impedance Spectroscopy Studies of the Charge transport properties of p-doped Poly(3,4-ethylenedioxythiophene)

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The electrochemical behaviour of conducting polymers is influenced by numerous factors such as the conditions of film preparation, the chemical nature of solvent and electrolyte, and the electrolyte concentration. The electrochemical impedance spectroscopy (EIS). of oxidized poly(3,4-ethylenedioxythiophene), PEDOT, modified film electrodes (on platinum) are studied in different solvents containing $LiClO_4$ as background electrolyte. EIS is a powerful technique to study charge transfer, ion diffusion/migration, and capacitance of conducting polymer modified electrodes.

EIS measurements of the PEDOT modified electrodes show that the impedance plots are dominated by a capacitive line in low frequencies. We can also observe a straight line with slope slightly less than unity in the Warburg region. The high frequency intersection with the real axis depends strongly upon the electrolyte concentrations. But, in the low frequency region, a constant capacitance value is observed for different electrolyte concentrations. Moreover, the low frequency capacitance increases linearly with the film thickness. These observations provide support for the porous medium approach. Thus, EIS results of PEDOT are analysed with the framework of distributed impedance models (transmission lines). The experimental results are in good agreement with the porous structure of PEDOT as observed with atomic force microscopy (AFM) and electric force microscopy (EFM).