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Characterization of conductivity relaxation processes induced by charge dynamics and hydrogen-bond molecular interactions in binary mixtures of propylene carbonate with acetonitrile

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ABSTRACT

The complex dielectric permittivity, alternating current electrical conductivity, electric modulus and impedance spectra of the binary mixtures of propylene carbonate with acetonitrile have been investigated by employing dielectric relaxation spectroscopy over the frequency range from 20 Hz to 1 MHz at 25 °C. It is found that the real part of dielectric permittivity represents the static dielectric permittivity of these mixtures in the frequency range from 100 kHz to 1 MHz, whereas it starts to increase sharply from static permittivity value and reaches up to five orders of magnitude with the decrease of frequency from 20 kHz to 20 Hz. This behaviour confirms the dominant contribution of absorbed charge contaminants in the dielectric polarization of these dipolar liquids at low frequencies. The electric modulus and impedance spectra of these binary mixtures exhibit the Debye-type dispersion behaviour. Electric double layers and conductivity relaxation processes induced in these mixtures exhibit non-linear behaviour with the mole fraction concentration of the mixtures constituents and the relaxation times of these processes have proportionality with dc electrical conductivity. The static dielectric permittivity, refractive index and excess properties of these dielectric parameters over the entire

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