

ORIGINAL PAPER

Electrical transport properties of poly(aniline-*co-p*-phenylenediamine) and its composites with incorporated silver particles

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Statistical copolymers of aniline and *p*-phenylenediamine, poly(aniline-*co-p*-phenylenediamine)s, were synthesised by oxidative polymerisation using various oxidants, ammonium peroxydisulphate or silver nitrate. Depending on the choice of oxidant, copolymers or composites with silver particles were obtained. Different molar concentrations of *p*-phenylenediamine in the reaction mixture provided materials of different conductivities. The influence of both the copolymer composition and the presence of discrete silver particles on the electric and dielectric properties of the system was studied. The results showed a decrease in the conductivity of copolymers and their composites with the silver content compared with the content of standard polyaniline salt. The reduction in conductivity was described in terms of the decreased density of hopping centres due to defects in the copolymer structure. The dielectric relaxations observed were described in terms of their activation energies and were linked to the corresponding conduction mechanism.

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Introduction

Conducting polyaniline (PANI) belongs to the group of conjugated polymers with conductivity of the order of several S cm⁻¹. The polyconjugated structure is a result of the strictly regular assembly of aniline constitutional units, thus enabling charge transport. The chain of conducting PANI contains more

than 95 % of *para*-substituted aniline units linked head-to-tail (Hagiwara et al., 1987). Any modification of this polyconjugated structure leads to a decrease in conductivity, as demonstrated by the copolymerisation of aniline with other monomers, such as pyrrole (Stejskal et al., 2004) or *p*-phenylenediamine (Křivka et al., 2001; Sarykov et al., 2004). In general, the oxidation of the mixtures of aniline

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