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# EPR, charge transport, and spin dynamics in doped polyanilines

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## Abstract

Charge transport and magnetic properties of films of polyaniline (PAN) doped with 10-camphorsulfonic acid and 2-acrylamido-2-methyl-1-propanesulfonic acid (AMPSA) have been studied by conductivity, magnetic-susceptibility superconducting quantum interference device measurements, and 3-cm and 8-mm electron paramagnetic resonance (EPR) spectroscopy at doping levels (x) from 0.3 to 0.9 over a temperature range from 15 to 300 K. The temperature dependences of conductivities were explained in terms of the advanced multiphase heterogeneous granular metallic (HGM) model with percolation including disordered metallic (DM) and non-metallic (NM) phases. The anomalous conductivity change in the PAN-AMPSAx system at T>240 K was accounted quantitatively for a solid-phase equilibrium with the occurrence of the disordered anion phase from the metallic islands. A means for analysis of the EPR line shape in conducting media has been developed and, with this, conductivity and microwave dielectric constants were estimated and two EPR signals, R1 and R2, were detected in both systems. It was shown that R1 signal belongs to pinned radicals of isolated polymer chains, whereas R2 is the weight-averaged signal, resulting from three types of paramagnetic centers, localized and mobile spins in the NM and DM phases, which interact via exchange. From the temperature and frequency dependences of the R2 linewidth the spin-diffusion parameters for the NM phase in both systems were determined. It was found that the HGM model allows good explanation of both charge transport and spin diffusion in the doped polyaniline films.