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Broadband dielectric response of polyaniline pellets as nanocomposites of metallic emeraldine salt and dielectric base

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Recently, we have studied dielectric spectroscopy of variously conducting polyaniline (PANI) pellets in a very broad frequency (10˘–2–10˘13 Hz) and temperature (10–300 K) range [1]. The DC conductivity varied between ≈10 S/cm for the emeraldine salt and ≈10˘–12 S/cm for the deprotonated emeraldine, the PANI base. Mechanism of the conduction consists of polaron transfer along the PANI chains and the reason for such dramatic differences is a result of various degrees of disorder within the chains and their arrangement [2]. Since the fully ordered metallic PANI films with DC conductivity of ≈10˘3 S/cm were also reported [3], we attempted here to model the whole dielectric and conductivity spectrum of our emeraldine salt pellets as a nanocomposite of the metallic PANI and our amorphous PANI base. For modelling of the conductivity including the THz and infrared part with vibrational modes we have used the effective medium approach based on Bruggeman and generalised Lichtenecker model [1]. Both models are discussed from the view point of topology and percolation of the conductive fraction and preferences of the latter model are demonstrated.
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