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Review

Electrical conduction through DNA molecule

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ABSTRACT

Several disorder parameters, inside the DNA molecule, lead to localization of charge carriers inside potential wells in the lowest unoccupied and highest occupied molecular orbits (LUMO and HOMO) which affects drastically the electrical conduction through the molecule, and demonstrates that the band carriers play an essential role in the conduction mechanism. So, a model is presented to shed light on the role of electrons of the LUMO in the electrical conduction through the DNA molecule. DC-, AC-conductivity and dielectric permittivity experimental data are well fitted with the presented model giving evidence that the free carriers in the LUMO and HOMO are responsible to make the DNA molecule conductor, insulator or semiconductor. The obtained results show that the localized charge carriers in the DNA molecule are characterized by four different types of relaxation phenomena which are thermally activated by corresponding four activation energies at 0.56 eV, 0.33 eV, 0.24 eV, and 0.05 eV respectively. Moreover, the calculations after the model, at room temperature, show that the time of the relaxation times of the current carriers are in the order of 5×10^{-2} s, 1.74×10^{-4} s, 5×10^{-7} s, and 1.6×10^{-10} s, respectively.

Contents

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