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Influence of Polarization on Electron Localization in the Coated Tetramer Nanoclusters Used as Elements of Biorecognition Systems

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A quasi-classicall theoretical model is proposed for describing the localization dynamics of a common (tunneling) electron in the coated metal-organic nanocluster in an external low-frequency electric field, taking into account the electron-vibrational interaction and the polarization effects on its centers and on the ligand (organic) shell. The case of a square-planar tetramer nanocluster with the tunnel-connected centers is considered. This model allows a detailed study of the controlling role of the electric field, taking into account the contributions from the electron-vibrational interaction and from the polarization effects, in the realization of the various electron localization regimes, and reveals the ability of such a nanocluster to switch between them. This model is actual and suitable for the nanostructured composite systems of such kind, which are widely used as the basic elements in the bio-recognition systems.