The addition of Frenkel excitons and charge transfer states defined by Al-pyrocatechol complexation

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In this study, the Al-pyrocatechol complexation was used to examine the addition of Frenkel excitons and charge transfer states (CT) as a result of optical excitation in nanostructures consisting of the Al-pyrocatechol complex. This compound was synthesized in aqueous systems by using a 1:1 metal-ligand complexation at pH 3.5, 7.0 and 9.0 in the presence of atmospheric pressure at 21 °C for a period of 48 h in total darkness. The complex was determined by using methods of UV-Vis spectrophotometry, scanning electron microscopy (SEM) and atomic force microscopy (AFM). In the UV region of the metal-ligand spectrum, an absorption maximum appeared at 278 nm. Within the Vis region of the spectrum, ligand bands from the complex occurred with absorption maxima of 597 nm and 650 nm that conformed to the orange and red light regions. As a result of complexation, a rise of the chromophore system appeared due to the addition of OH auxochromes causing an increase of the absorption intensity. This highly conjugated system of the complex showed favorable reaction to Frenkel excitons and charge transfer states. SEM and AFM images showed highly ordered structures of the complex that were suitable for these systems. The addition of Frenkel excitons and charge transfer states was determined by applying the calculation of Hamiltonian function that was appropriate to describe complicated systems of identical molecules. This model describes the propagation of charge carrier along the donor and the acceptor stack of a linear crystal of charge transfer complex. Furthermore, it was assumed that Frenkel excitons were located on the donor and the acceptor molecules. In consequence of the Al-pyrocatechol complexation, it was showed that the addition of Frenkel excitons and charge transfer states provided additional channels of lattice polarization induced by the electric field of charge carrier in structure. As a result, these additive effects resulted in an increase of the charge density which is useable in energy research and technology.

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