

Nanocomposites and nanomaterials

Polymer nanocomposite for the active layer of organic photovoltaics

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Organic solar cells have been the low cost complementary to inorganic solar cells. Possibility of chemically manipulating the properties of polymers combined with a variety of easy and cheap processing techniques has made polymer based materials present in almost every aspect of modern society [1]. We choose subjects, which, recently, were used for development of polymer composites of polymethine dyes with high photosensitivity in a wide spectral range [2].

A comprehensive study of the optical properties (absorption spectra; photoluminescence excitation and emission spectra) was performed for solutions and films with thickness in the range of 30-100 nm of poly-vinylcarbazol (VC) polymers and copolymers with substituents to both the polymer chain and directly to carbazole moiety. And also the influence of a matrix material on optical and photovoltaic properties of nanocomposite films with polymethine dyes at high concentration was analyzed. We used V₂O₅ xerogel, polyvinyl alcohol, polyphenylenevinylene, polyvinyl carbazole and its derivatives as matrices and Indocyanine Green, Meso-Cl, Hexaindoletetricarbocyanine and sulfonamided zinc phthalocyanine as dyes.

We have established that the attachment of OMA group to VC polymer significantly increases solubility, ductility and molecular ordering in the films.

We determined that H-aggregates of the dyes formed in the films of polymer composites. Some H-aggregates have higher efficiency of charge carrier photogeneration than that for quasi-isolated molecules of the dyes. Spectral region of HITC/PPV composite sensitivity is wider than spectral dependence of developed plastic solar cells based on the polymer with C₆₀ derivatives. Obtained data can be used to develop new methods of increase of photosensitivity for polymer composites in a wide spectral range.

1. [Xue J.](#) Perspectives on organic photovoltaics // Polymer Reviews. -2010. -[50](#). - P. 411-419

2. [Vertsimakha Ya., Verbitsky A.](#) New method of preparation of composites promising for the development of plastic solar cell: in: Solar Cell Research Progress (Ed.J.Carson), Chapter 8, pp. 297-317. Nova Publishers, NY, 2008.