From Photophysics of π-Electron Containing Synthetic Macromolecules to Biophotonics

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Abstract - **In this paper the short review of the fundamental and applied investigations of π-electroncontaining polymers including biologic compounds is presented.**

Keywords – **Nonconjugated polymers, energy transfer, fluorescence, phosphorescence, nanoelectronics, biophotonics.**

I. INTRODUCTION

The electronic processes in π-electron-containing polymers were the objects of the intensive fundamental investigations from 60^{th} to 90^{th} of previous century.

There are two types of such macromolecules: with non-conjugated π-electron-containing groups and conjugated groups. Both types of polymers were very interesting to fundamental science but non-conjugated polymers were the first: polystyrene [Avivi P. et al], polyvinyltoluene [Powel K. et al], polyvinylnaphtaline [Webber S.E. et al, Fox R.B. et al], polyvinylcarbazole [Klopfer W., Faidysh A., Burkhart R.], polyvinylbenzocarbazole [Itaya A.] and even DNA [Shulman et al, Isenberg et al]. The main reason of such interest was the idea of treatment of these polymers as one-dimensional molecular crystals. The other reason was the huge perspective of using of these polymers in information recording, scintillators, molecular electronics etc. This paper is devoted to the results of fundamental and applied investigations of π-electroncontaining polymers including biologic compounds.

II. RESULTS AND DISCUSSION.

The main electronic properties of nonconjugated π-electroncontaining polymers are examined: absorption, fluorescence [1], phosphorescence [2] and delayed fluorescence [3]; electronic excitation energy transfer and capturing by intrinsic host and quest traps.[4] It was shown how knowledge of the peculiarities of electronic processes can be used for applied problems such as the design of functional macromolecules [5]; information recording[6], photostabilization of polymers [7], chemical engineering, manufacturing of high-effective OLEDs [8, 6]. It is demonstrated that namely organic polymers containing nonconjugated π-electron groups in their chains are very perspective for nanoelectronic devices design and fabrication [9].

The wonderful properties of nonconjugate organic polymers that changing of some polymer cell do not disturb essentially the energy levels positions of others, were effectively used by Nature in the fabrication of such vitally important biopolymers as DNA [10], RNA [11] and some proteins [11]. To the other hand, the biological macromolecules and such constructions (from these macromolecules) as viruses can be used for electronic devices [9] as a template for fabrications of unique monoparticles. In present paper it was demonstrated the example of such functional macromolecule consisting of DNA-fragments [9].

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III. CONCLUSIONS

For good applications the fundamental investigations are necessary.

The Nature used the peculiarities of electronic properties of organic media very skilful for design of functional macromolecules such as DNA and RNA.

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