Nanocomposites and nanomaterials

Photocatalytic degradation of methelene blue on nanostructured composites based on TiO_2 and polymethine dye

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Selective sensitizing of photocatalytic systems promotes their activity within some wavelength region and this is one of the important fields in the photocatalytic systems design and development. Some photocatalytic systems can be suitable for use in the visible and infrared solar energy transformation and accumulation equipment, which is a very promising direction. Previous investigations proved that systems combining photoactive oxide (TiO_2) with pigment-sensitizer or other long wave sensitizing compound can be effectively used as photocatalysts.

Here we describe a method to design the solid and structurally oriented photosensitive heterostructures (the blocks). Needful amount of the pigment should be applied on the semiconductor surface and then protected from dissolution by the polymer film.

There are numerous applications of the heterostructures: photocatalytic decomposition of water [1], reduction of methylene blue [2] and oxidation of potassium iodide [3]. Therefore, it is interesting to see if this approach to development of highly effective light sensitive systems can also be extended to construction of some other types of the light sensitive modules and dyes-sensitizers.

New light sensitive heterostructures working through all visible light wavelengths and containing a semiconducting material (TiO_2), a polymethine pigment-sensitizer, and a polyepoxypropylcarbazole polymer, which protects the material from dissolution, have been developed. Our results prove that such heterostructures can be used as active photocatalysts. Dependence of their photoactivity on the quantitative composition has been established and energy characteristics of the electronic processes occurring upon light absorption have been analyzed. We have also proposed mechanism explaining photocatalytic activity of these complex materials.

1 *S.Ya. Kuchmiy et al*., Theor. and Exper. Chem. **31(6)**, 370 (1995).
2 *I. Kobasa et al.*, Funct. Mater. Lett. **3(4),** 233 (2010).
3 *N.B. Husiak et al*., Funct. Mater. Lett. **7(3),** 1450030 (2014).