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A NOVEL TECHNIQUE TO SYNTHESIZE NANOPARTICLES OF TITANIUM DIOXIDE, CADMIUM SULFIDE, AND SILICON DIOXIDE, CAPPED WITH 2,2-BIPYRIDINE COMPOUNDS

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The dynamics of electron transfer in the molecule–nanoparticle system and charge-transfer intramolecular complexes of TiO_2, SiO_2, and CdS were compared. Charge-transfer complexes and intramolecular charge-transfer complexes with superfast electron transfer–bipyridine–TiO_2 and bipyridine–SiO_2– were obtained. Both complexes are characterized by similar charge transfer bands and donor (bipyridine) and acceptor (Ti or Si) orbitals. The electron is localized on titanium or silicon sites in the metal–bipyridine complex but can be localized on the other Ti, Si, and CdS sites in TiO_2 and SiO_2 nanoparticles. The reverse dynamics of electron transfer from titanium sites to bipyridine ligands in the time interval of 200 fs is observed in the molecular complex. Titanium–cadmium–bipyridine (TCB) and silicon–cadmium–bipyridine (SCB) systems were synthesized and purified by two methods: Blodgett and sol–gel. The synthesized compound was identified by elemental analysis, X-ray powder diffractometry, infrared spectroscopy, scanning electron microscopy, and spectrophotometry in the ultraviolet and visible regions of the spectrum. The optical properties of the samples were investigated.

***Key words**: synthesis of titanium dioxide, cadmium sulfide, and silicon dioxide nanoparticles capped with 2,2-bipyridine compounds, X-ray powder diffractometry.*

Semiconductor nanomaterials are under intense investigation as nonmolecular materials manifesting quantum [1] and dielectric confinement. As a result of their elevated light activity and photoreactivity as well as nonlinear optical properties, these materials can be synthesized by a wide range of methods. Some particles can be obtained by chemical methods [2], with new configurations being formed, for example, a superlattice of quantum dots.

Interfacial electron transfer between nanoparticles of a semiconductor and molecules of an adsorbate is a fundamental process determining the areas of application of these materials, for example, solar energy conversion [3] and nanodevices. Recent studies of photocatalytic light-sensitive nanoparticles and thin films of titanium dioxide confirm that electron injection

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