

# Novel light-sensitive materials with photocatalytic activity: heterostructures containing cadmium sulfide, cyanine pigment, and polyepoxypropylcarbazole

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Novel heterostructures containing cadmium sulfide, bis-[N-phenyl-4-carboxybenzo(f)-chinoline-2]-carbocyanine boronfluoride and polyepoxypropylcarbazole have been obtained. It is shown that the heterostructures can work as photocatalyst for the reaction of methylene blue reduction at exposition to the visible light. Correlation between photocatalytic activity of heterostructures and their quantitative composition and spectrum of exciting light has been established. The energetics of heterostructural photocatalytic systems has been estimated and possible mechanism of processes occurring at exposition to light has been discussed.

Получены гетероструктуры, содержащие сульфид кадмия, бис-[N-фенил-4-карбоксивензо-(f)-хинолин-2]-карбоцианин борфторид и полиэпоксипропилкарбазол. Показано, что они могут выполнять функцию фотокатализаторов реакции восстановления метиленового голубого при облучении реакционных смесей видимым светом. Установлены зависимости фотокаталитической активности гетероструктур от количественного состава и спектрального участка возбуждающего света. Сделана оценка энергетики фотокаталитических систем на основе гетероструктур, рассмотрены возможные механизмы процессов, проходящих при воздействии света.

Light-sensitive semiconductors with photocatalytic properties are materials of a very great importance among functional materials due to possibility of their use for resolving such important problems as solar energy transformation into electricity or ecologically pure chemical energy; photocatalytic synthesis of valuable compounds, photo-decomposition of toxic wastes and pollutants; new information technologies, etc. However, most light-sensitive semiconductors are not in wide use yet, since their properties do not meet requirements set for high-efficient industrial photocatalytic processes. Many laboratories are involved into investigations purposed to improve the photosensitive semiconductors properties. For example, the materials sensitive in near

IR and visible range are under development [1–8]. Resolving of sensitizing problem is another promising direction. This means obtaining solid light-sensitive blocks of highly organized structure (heterostructures) which contains a semiconducting photocatalyst and a pigment sensitizer attached thereto [6, 9]. This paper describes novel heterostructures, investigation of their photocatalytic activity and it also proposes possible mechanism of processes occurring in the heterostructures at the light absorption.

We used polycrystal cadmium sulfide (specific surface  $4.0 \text{ m}^2/\text{g}$ ) and pigment (D) bis-[N-phenyl-4-carboxybenzo(f)-chinoline-2]-carbocyanine boron fluoride. This pigment belongs to cyanine pigments which are widely used in photographic materials pro-