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New photoactive materials containing photocatalyst and catalyst on high-silica NaY zeolites

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Composite materials based on high-silica NaY zeolites comprising a molecular photocatalyst (titanium (IV) compounds) and a catalyst (palladium metal) have been developed. The spectral properties of materials obtained have been studied as well as their stability and photocatalytic activity in the reaction of hydrogen evolution from water-alcohol mixtures under irradiation by near UV light. The factors influencing the photocatalytic activity of the composites have been considered and their improved activity as compared with molecular systems based on titanium compounds has been shown to be due to the structural organization of the molecular photocatalyst-metal catalyst system.

Разработаны композитные материалы на основе высококремнеземистых цеолитов NaY, содержащих в своем составе молекулярный фотокатализатор (соединения титана (IV) и металлический (палладиевый) катализатор. Исследованы спектральные свойства полученных материалов, их стабильность и фотокаталитическая активность в реакции выделения водорода из спиртово-водных смесей при действии света ближней УФ области спектра. Рассмотрены факторы, влияющие на фотокаталитическую активность композитов, предложено объяснение природы их более высокой активности по сравнению с молекулярными системами на основе соединений титана как результат структурной организации системы "молекулярный фотокатализатор – металлический катализатор" в композите.

The search for new potential photocatalysts intended for the solar energy transformation into electric or chemical one, for information recording and storage, for rendering harmful the environment pollutants, and for realization of other transformations due to the light action draws now a particular attention. This is connected with the importance of problems mentioned as well as with that the known photocatalysts are still unsuitable for development of high-efficient catalytic systems. The molecular designing of composites possessing photocatalytic properties is among approaches of promise in obtaining photoactive materials [1].

Such functional materials must contain a photocatalyst and one or more components that, remaining unchanged, are included into the photocatalytic process and favor its running. Those additional components include compounds sensitizing the photocatalyst to longer-wavelength light, substances enhancing the photogenerated charge separation efficiency, catalysts of the process dark steps, and electron carriers. The structural organization providing the rigid immobilization of any such component in the nearest neighboring of the photocatalyst allows to reduce the efficiency losses inherent in unorganized systems and connected with kinetic hindrances, in particular, with the necessity to transfer electron between the components during a time not exceeding the excited state lifetime of one component.

The designing of functionally and structurally organized materials having an en-