Energy storage photocatalytic systems of Fenton type with the enhanced biocide activity

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Energy storage photacatalytic systems comprising the mosaic films made of TiO_2/MoO_3 nanoheterojunctions exhibit a long-term biocide activity upon UV expose retaining at least for 8 h. Contrastingly to the conventional TiO_2-based photobiocide coatings exhibiting self-sterilization through generation of hydroxyl radicals under UV irradiation, the pathophysiological activity of TiO_2/MoO_3 photocatalyst is due to hydrogen peroxide production accompanying oxidation of Mo^{5+} centers (produced during the course of photoaccumulation of negative charge) and thus retains in the dark [1]. Our studies have shown that modification of the surface of TiO_2/MoO_3 nanoheterojunctions with $NiMo_6O_{24}H_6^{4-}$ capable of rapid conversion of hydrogen peroxide yielding OH radicals, results in *ca*. 2-fold increase in the probing dye oxidation efficiency (Fig. 1) and leads to the corresponding enchantment of biocide activity against *E. coli* bacteria. Moreover, hydroxyl radicals known to be the most efficient oxidant among other reactive oxygen species behave as the non-selective killing factor, being thus effective against both gram-negative bacteria and gram-positive ones which differ as to the oxidation resistance of lipids forming the envelop. The poyoxometallate molecules immobilized at the TiO_2/MoO_3 surface are also involved in the photoinduced charge storage resulting in the enhanced efficiency of photoaccumulation.

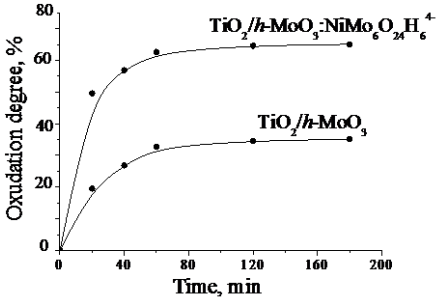

Fig. Degradation kinetics of Rhodamine 6G under dark conditions at photocatalysts pre-exposed to UV light for 10 min. $NiMo_6O_{24}H_6^{4-}$ deposited onto the surface of MoO_3 particles behaves as the catalyst of Fenton reaction.

References

[1] T.V. Sviridova, L.Yu. Sadovskaya, E.A. Konstantinova, N.A. Belyasova, A.I. Kokorin, D.V. Sviridov. Catalysis Letters. 149 (2019) 5: 1147