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Oxidative photo-catalytic destruction of eosine with the application of iron-contalning metal-ceramic composites with additive complex-forming reagents

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Abstract

Iron-containing metal-ceramic composites based on nitrogen and sialon nitrides, obtained by the method of self-propagated synthesis were studied in the process of photocatalytic oxidative destruction of eosin. The phase composition of the samples was established by the X-ray diffraction method. It was shown that, along with the main phases, the ceramic matrix of materials contains the phases of semiconductors: (SiC, TiN). The indicator method of Hammet and Tanabe assessed the surface acid-base centers of the composites. It was established that a large sorption of the dye is characteristic of samples based on silicon nitride and sialon and is associated with the participation of active Brensted acid sites. The photocatalytic activity of iron-containing composites was studied in the presence of H_2O_2 (photo-Fenton system), H_2O_2 and EDTA (peroxide-ferriccomplexon system), H_2O_2 and tartaric acid (peroxide-ferritartrate system). It was shown that the degree of oxidative destruction of eosin is significantly higher with the participation of Fe(II, III) complexes with EDTA and tartaric acid, than Fe(II, III) aquacomplexes in the photo-Feton system. The high activity of composites containing the semiconductor phase of titanium nitride (TiN) is due to the combination of homogeneous and heterogeneous catalysis with the participation of the ceramic matrix. The introduction of complexing agents shifts the optimal acidity (pH 2-4) for a homogeneous system of photo-Fenton with the participation of iron(II, III) aqua complexes in the weakly acidic region (pH 4-7) and leads to almost complete destruction of the dye in the peroxide-tartrate system.

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