TiO_2 NANOTUBES DOPED BY AG, AU AND PT OR COVERED BY AG, AU AND PT NANODOTES AND THEIR APPLICATION AS NANOMOTORS.

Mihail Enachi[1,*], Postolache Vitalie[1], Veaceslav Ursaki[2], Ion Tiginyanu[1]
[1]*National Center for Material Study and Testing, Technical University of Moldova.*
[2]*Institute of Applied Physics, Academy of Science of Moldova.*
*E-mail:enachem2002@yahoo.com

Abstract. An anodic oxidation of titanium foils in an electrolyte containing a mixture of hydrofluoric acid, ethylene glycol, and phosphoric acid was used to obtain titania nanotube arrays. The initially amorphous nanotubes were crystalized in an anatase phase upon thermal treatment at 500 °C. The impact of doping with Ag, Pt, and Au noble metals as well as covering of sample surfaces with noble metal nanoparticles upon their capabilities to photocatalytically degrade the Rhodamine B was investigated. A positive effect was revealed for samples doped with Ag.

Titanium dioxide (TiO_2) presents a great interest for many applications such as photocatalyst [1] and is also interesting from the point of view of demonstrating nanoengines for biological applications and for the transport of medicine in the human body. These artificial nanomachines are powered by simple chemical reactions, usually by chemical decomposition of H_2O_2 [2]. Investigation of photocatalytic properties of TiO_2 nanotubes, including nanotubes doped with catalytic metals in relations with photocatalytic decomposition of various chemicals is an important topic.

In this paper we investigate the influence of thermal treatment, doping, and deposition of noble metal nanoparticles on arrays of titania nanotubes prepared by anodic oxidation upon their photocatalytic properties with respect to photocatalytic degradation of Rhodamine B.

For dots covering, 50 nm thick Au, Ag, or Pt films were deposited on the surface of already produced TiO_2 nanotube arrays, after, the samples were annealed at the temperature of 500 °C. The result is illustrated in Fig. 1. As concerns the efficiency of Rhodamine B degradation for TiO_2 arrays doped with catalytic metals, or covered by metal nanoparticles, the results of investigations are shown in Fig. 2. Only doping of TiO_2 nanotube arrays with Ag accelerates the degradation of the dye, while doping with Pt or Au, as well as covering samples with metal nanoparticles attenuate the photocatalytic properties.

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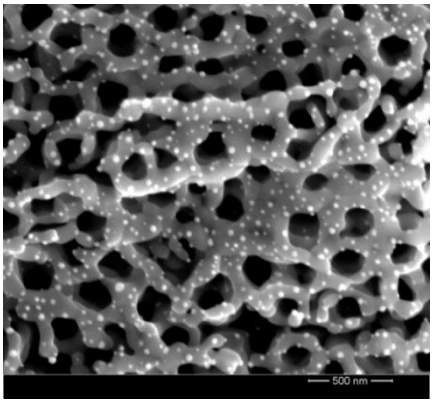

Figure 1. SEM images of TiO_2 nanotubes covered by catalytic metal nanoparticles.

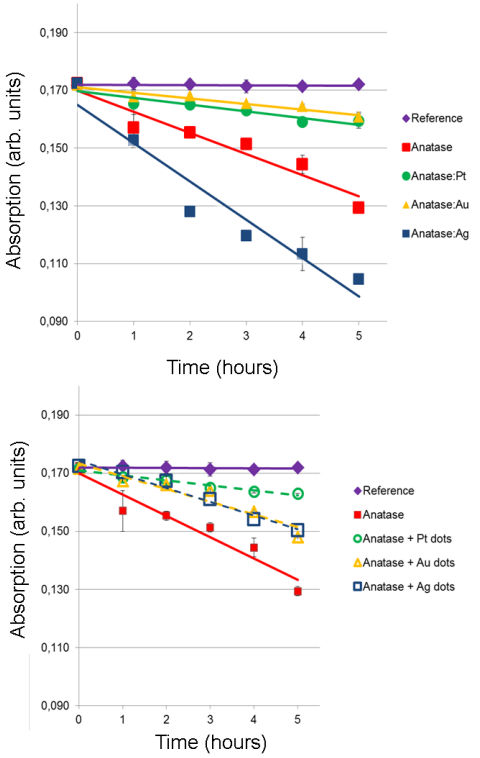

Figure 2. Dependence of the absorption upon exposure time for samples with anatase structure doped with Au, Ag, or Pt (a); and for samples covered by metal nanodots (b).

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