Effect of doping metals on the structure of PEO coatings on Ti

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Mixed oxide systems $TiO_x \cdot MO_y$ (M = Mo, W, V, Zr) were formed on titanium alloys by plasma electrolytic oxidation (PEO). Electrochemical treatment performed in aqueous electrolytes based on pyrophosphates, borates and acetates of alkali metals with addition dopants' oxides or oxo-anions. The process was carried out at current densities of 1 – 5 A/dm^2 and a total voltage up to 250 V in a thermostatic cell with vigorous stirring of the electrolyte and flow-through circulation cooling. The processing time was 30 – 90 minutes.

The surface morphology and content of alloying elements in the coating are highly dependent on the dopants nature [1]. Formation of oxide layers from electrolytes based on the rare metals dispersed oxides produces uniform coating with low-porosity and doping components content ω, at %: Mo–3, V–4 and Zr–4. Analysis of the components distribution and the surface topography of $TiO_x \cdot WO_y$ coatings obtained by PEO from electrolytes based on tungstates of various concentration allows us to conclude that the clusters hills are enriched in tungsten and the matrix – by titanium, while the structure of the deposits is tubular. The surface topography of the $TiO_2 \cdot ZrO_2$ system significantly differs: oxides have a fine-crystalline structure with the maximum surface development degree in the series of rare dopants [2]. The spread of the grain agglomerates sizes is 150–300 nm, and the height varies from 100 to 500 nm. The cross-sectional profile of the $TiO_2 \cdot ZrO_2$ agglomerates is characterized by a variety of grain shapes with a predominance of pointed crystallites. Heat treatment of mixed oxide coatings changes the topography of the surface. It acquires a globular shape and becomes more uniform, the sizes of the agglomerates decrease to 140–200 nm, and the grain sizes remain in the range 80–100 nm. The uniformly developed surface is one of the factors ensuring an increase in catalytic activity of the $TiO_2 \cdot ZrO_2$ system after thermal treatment.

1 *Sakhnenko N., Ved M., Karakurkchi A., Galak A.* A study of synthesis and properties of manganese-containing oxide coatings on alloy VT1-0 // East-Europ J Enterpr Technol. – 2016. – 3, N 5(81). – P. 37–43.

2 *Sakhnenko N., Ved M., Bykanova V.* Characterization and photocatalytic activity of Ti/TinOm·ZrxOy coatings for azo-dye degradation // Funct Mater. – 2014. – 21, N 4. – P. 492– 497.