

ELECTROCHEMICAL NANOCOMPOSIT MULTIFUNCTIONAL COATINGS: SYNTHESIS AND PROPERTIES

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The creation of compact equipment and devices without the use of the latest materials with a wide range of functional properties is impossible in the period of the rapid development of new directions in various industries and environmental technologies. One of the ways to solve this problem is to form thin electrolytic coatings on the surface of traditional structural materials. Such coatings make it possible to increase the strength characteristics, increase the temperature range of use, and also impart a spectrum of new valuable properties to the materials. To expand the possibilities of using electrolytic coatings, in addition to pure metals, composites and alloys are used, consisting of two or more components.

The formation of such coatings on different metals and their alloys is proposed by the change in the method of electrochemical treatment, depending on the type of processed material (plasma electrolytic oxidation or cathodic deposition), composition of working electrolytes and electrolysis parameters. The use of complex electrolytes based on alkali metal diphosphates and the "decreasing power" mode allows to form the coatings incorporated by the transition, noble, rare and scattered elements. The formed coatings have a high content of the doped component, developed morphology and topography of the surface (fig. 1).



Fig. 1. Surface morphology of electrochemical nanocomposit coatings

The studied nanocomposites are three-dimensional structures with a complex surface relief. The degree of development of the surface layer depends on the content of dopant. These characteristics will affect the functional properties of the synthesized coatings.

Among the advantages of using these technological solutions, it should be noted that there is no thermal effect on the material of the products, which can cause undesirable changes in the structure and physical and mechanical properties of the metal; insignificant material costs for work; formation of coatings of a given thickness with a minimum allowance for machining and increased functional properties; the ability to automate the process with the simultaneous processing of a significant number of parts, which generally reduces the cost of the technological process. The obtained functional materials do not require further treatment and have the synergistic properties, including catalytic activity, mechanical strength, corrosion resistance, heat resistance, etc. This is confirmed by the results of laboratory and research and industrial tests.

The obtained coatings can use in many industries, such as, ecocatalysis, chemical energy and automotive industry, microelectronics, photovoltaics, sensors, utilities and others. The practical significance of the obtained results lies in the formation of coatings with high content of active components and given functional properties.