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Functional oxide structures on a surface of metals and alloys

Rudnev V. S.[1], Yarovaya T. P.[1], Boguta D. L.[1], Lukiyanchuk I. V.[1],
Tyrina L. M.[1], Morozova V. P.[1], Nedozorov P. M.[1], Vasilyeva M. S.[2], Kondrikov N. B.[2]

(1. Laboratory of Plasma Electrolytic Processes, Institute of Chemistry of Far-Eastern Branch of the Russian Academy of Sciences, Vladivostok 690022, Russia; 2. Far Eastern State Universary, Vladivostok, Russia)

The investigations of the plasma electrolytic processes in our laboratory are aimed to the development of conditions of formation of oxide layers with determined composition, structure and functional properties on the surface of valve metals (Al, Ti) and their alloys. Plasma electrolytic oxidation or deposition (PEO) is the formation of inorganic layers on metals from electrolyte solutions by means of electric discharges. We use both anodic polarization of metal electrodes and alternating anode-cathode one. In China PEO is named microarc oxidation (MAO). Nowadays the number of publications of Chinese authors on this theme is promptly increasing.

Our investigations are directed at formation conditions development of both protective coatings (i) and layers of different composition and structure (ii).

(i) On the first direction. (a) The PEO technology of aluminum and titanium constructions treatment for seawater corrosion protection, as background for painting, coating of varnishes and polymers is developed. Using PEO technology for surface preparation instead of chemical or electrochemical oxidation has resulted in double increase of working life of constructions. (b) The technique of coatings obtaining increasing operation resource of aluminum wares in friction units is proposed. We used one-component electrolyte, which didn't need in cooling. The thickness of coatings was from 30 up to 80 microns. The duration of process was from 30 to 120 minutes.

(ii) On the second direction. (a) Basic regularities of PEO-layers formation in electrolytes contained polyphosphate complexes of metals are established. Sandwich-type films consisted of high-temperature phosphates of metals and/or spinels are obtained. For example, $Mn(PO_3)_2$, $Mn_2P_2O_7$, Mn(II)Mn(III)Ti $(PO_4)_3$, $MnAl_2O_4$, $NaZnPO_4$, $ZnAl_2O_4$, $NaMgPO_4$ are among them. The possible application fields of such structures are extensive: catalysts and supports for catalysts, adsorbents, antimicrobial and bactericide layers, luminophores, background under paining etc. Antimicrobial activity of films containing zinc (II) phosphate has been shown. Methods of colour layers formation have been developed. (b) Investigations of regularities of PEO-layers deposition in electrolytes containing heteropolyoxoanions are carried out. The formation conditions of films including tungstate and vanadate heteropolyanions thermolysis products such as WO_3, $WO_{2.9}$, $Al_2(WO_4)_3$, V_2O_4, V_2O_5 etc. have been obtained. The films simultaneously contai-

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ning compounds of Ni(II) and V(V), W(VI) and V(V). The investigations directed to obtain MoO_3 films are proceeded. (c) We carry out studies of PEO processing in electrolytes evolving the precipitates. The composites $Ti/TiO_2/Mn_2O_3+Mn_3O_4$ are obtained. General approach of formation of PEO-structures including transition metals oxides has been suggested. (d) One of the application fields of layers of compound composition is catalysis and electro catalysis. We start investigations of the activity of obtained structures row, for example, at present we study the activity of $Ti/TiO_2/Mn_2O_3+Mn_3O_4$ in the reaction of CO oxidation.

We hope for finding Chinese partners interested in realization of united investigations and application of available designs.