SEAE 41P SURFACE MODIFICATION OF STRUCTURAL STEELS AND TITANIUM ALLOYS BY SYNTHESIZING CARBIDE PHASES WITH ELECTRO-SPARK ALLOYING ELECTRODES OF TRANSITION METALS IV - VI GROUPS AND GRAPHITE

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It is known the first attempts to use graphite for hardening the surface of titanium in the process spark alloying (ESA). In the surface layers of titanium after ESA graphite phase titanium carbide were found. This fact proves that under the action of pulsed discharges titanium reacting with carbon occur to form titanium carbide. Taking into consideration that standard hard alloys composed of two or even three of the carbides, it would be useful to expand the range of studies, using more transition, metal carbide, which together with the graphite ESA allowed to receive the carbide phase in the surface layers of structural alloys. The actual work is aimed to research the possibility of modification of structural steels and titanium alloy surface by successive electric spark electrodes of transition metals Group IV-VI and graphite. Pure titanium (Ti), tungsten (W), molybdenum (Mo) and chromium (Cr), which carbides are most prevalent in the industry, have been chosen from the wide range of transition metals. Rods of titanium, tungsten, molybdenum and chromium, 45 mm long and 4.0 mm in diameter, and made of graphite-C × 200 June 3 and TU 16-538-019-69 "Coals spectrally pure "P-3 of 6 × 200 TU 16-538.240-74 a rod length of 40 mm and a diameter of 6,0mm have been used as anodes (electrodes machining). Cathodes (substrate) are plates of the size 15x15x5 mm structural steel 45, BT1 commercial titanium and titanium alloys OT4, VT6, VT22.

ESA process have been carried out on different commercial and experimental machines at a discharge energy modes within 0,3 ... 3,0 J ,using vibrating and rotating applicator. At the first stage the cathode surface (parts) have been exposed ESA by a transition metal with a certain time, depending on the magnitude of the electrical pulse energy of 1 to 2 min / cm^2.Then the same surface was processed with the graphite electrode. To provide thicker hardened layers interleaving processing by metal electrode, and then by graphite was carried out for several times in some cases.

That way obtained samples have been investigated at various instruments for solid material studying. After the ESA X-ray studies of the surface sample layers showed the presence of carbide phases of graphite and the metal, which was carried-tension doping in all cases. For example, at ESA first by tungsten, and then by graphite, tungsten carbides WC and W_2C, as well as free carbon were detected in the formed layer. Worth to point out, titanium carbide (TIC) and the carbide of the metal, which was carried out ESA, for example, chromium carbide (Cr_3C_2)have been detected, when the substrate is processed by titanium some of these metals, and then by graphite in the surface layers, when ESA was performed electrode of chromium. The fact that carbides are formed in the superficial layers of titanium alloys and steels in processing by the above-mentioned metal and graphite confirms their high hardness and wear resistance, which was examined under boundary lubrication at different loadings in the range of 200 ... 900 N.

Thus, the results of preliminary studies of the process of the ESA electrodes of some transition metals (Ti, W, Cr, Mo) graphite allow to yield carbide phases on the surface of structural alloys with high physical-mechanical characteristics. This fact creates preconditions for expanding possibilities of the method and in some cases to replace expensive electrodes made of hard alloys produced in a powder metallurgy.

Acknowledgments: This study was founded from Moldavian national project CSSDT 15.817.02.05A "Physico-chemical methods and engineering aspects of new materials and surfaces obtaining for multiscale technologies"