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V.V. Malyshev [1,2], professor, d.t.s.
N.N. Uskova [1], senior research worker, c.ch.c.
V.G. Glushakov [1], engineer
A.I. Gab [3], senior research worker, c.ch.c.
G.F. Nikulina [2], associate professor, c.t.s

# ALLOYS AND INTERMETALIDES OF MOLYBDENUM (TUNGSTEN) WITH NICKEL (COBALT) : ELECTROCHEMICAL STUDY, ELECTRODEPOSITION OF COVERAGES AND THEIR PROPERTY

[1] V.I. Vernadskj Institute of General and Inorganic Chemistry of the NASU, Kyiv, Ukraine,
[2] Open International University of Human Development «Ukraine», Kyiv, Ukraine,
[3] National technical University of Ukraine «KPI», Kyiv

At the cathode coprecipitation of metals an important value is had accordance of their crystalline grates and difference of standard electrode potentials.

Distrubance of continuous layers of alloy of molybdenum and tungsten in chloride fusion authors of works [1-3] кregister to considerable diffusive difficulties in delivery of ions of more electropositive rhenium to the cathode. It is not discovered at the study of cathode coprecipitation of these metals of dysplasias of continuous layers of molybdenum - tungsten alloys.

In a practical aspect is important at the study of features of electrodeposition of alloys components of which have crystalline grates different type, but near electrode potentials. To these requirements in fusion of *NaCl-KCl* answer molybdenum (tungsten) and nickel. The connected fallouts are deposit only on backing material from a graphite, copper, nickel and noble metals.

Oxide tungstste-molybdate fusions of $Na_2WO_4$-$MO_3$ (where *M* - *Mo* or *W*) used for the electrodeposition of molybdenum (tungsten) coverage's.

The basic methods of researches was a chronovoltamperometry with speeds of involutes of potential from 5 $10^{-3}$ to 5.0 V/s. Experiments carried out in an air atmosphere in a quartz reactor or reactor from heat-resistant stainless steel. By an anode and container for fusion at the chronovoltamperometry measuring served the platinum crucible, and in experiments on deposition of alloys - alundum. As indicatory electrodes used platinum, nickel and cobalt electrodes. The electrode of comparison a platinum-oxygen electrode served as - 0.8$Na_2WO_4$-0.2$WO_3$/*Pt*, air. The tungstate of sodium had qualification of «osch», oxides of molybdenum, tungsten, nickel and cobalt – «khch». Reagents before the use dried in a vacuum at the temperature of 200-250 °C during 10-12 hours and then fire at temperature 400-450 °C.

The got fallouts studied sciagraphy, microroentgen-spectral and metallography methods with the use of devices of DRON-4.0, Cameca and Neophot-21. a microhardness was measured by the device of PMT-3.

On current-voltage dependences in tungstate fusion, containing the oxide of nickel (II) or oxide of cobalt (II), looked the wave of renewal at potentials -(0.7-0.8) and -(0.8-0.9) V accordingly.

The mechanism of formation of electro-active particles becomes clear, if to come from the pattern of existence in tungstate fusions of acid-basic equilibrium. In cleanly вольфраматном fusion there is equilibrium

$$2WO_4^{2-} \Leftrightarrow W_2O_7^{2-} + O^{2-} \ . \qquad (1)$$

At addition of nickel oxides and cobalt (II) activity of ions of oxygen increases, potential of oxygen electrode decrease. Similar dependence is explained by flowing of reaction :

$$Mo \Leftrightarrow M^{2+} + O^{2-} \ , \qquad (3)$$

and electrode process in these conditions it is possible to present as follows:

$$M^{2+} + 2e \Leftrightarrow M^0 \ . \qquad (4)$$

Quantity of electrons, participating in an electrode process, determined on the difference of potentials of peaks and semipeaks of non-stationary current-voltage dependences of $E_{p/2}$ - $E_p$ = 2,2 $R{\cdot}T/n{\cdot}F$. At speed of polarization higher 0.5 V/s there is a transition from a convertible electrode process to quasi reciprocal one.

With addition of oxide of molybdenum (VI) to nickel containing tungstate fusion the wave of renewal of dimolybdate-ion appears:

$$Mo_2O_7^2 + 6e \Leftrightarrow Mo + MoO_4^{2-} + 3O^{2-} \ , \qquad (5)$$

As a base electrolyte for deposit of wide composition alloys fusion of $Na_2WO_4$-2.5 mole. % $MoO_3$ was used. It was set that at the density of current from 0.02 to 0.10 A/sm$^2$ molybdenum coverage's have a columnar structure and thickness to 100-150 mcm at the microhardness of 180-190 кГ/mm$^2$. A further electrolysis did not increase the thickness of coverage. The concentration columned distributions of molybdenum and nickel between coverage and nickel basis testify to the interdiffusion of elements of coverage and basis, what provides the high-quality adhesion between them.

For the cathode coprecipitation of metals in an alloy a molybdenum anode was replaced to more noble – by nickel and an electrolysis was carried out at the cathode current density 0.05 and 0.1 A/sm$^2$. The increase of concentration of $NiO$ or temperatures and decline of cathode density current of is conduced to the increase of content of nickel in deposit. From fusions, containing 0.1-1.0 mole % $NiO$, at a temperature 1123-1173 K on a cathode the continuous layers of intermetallides $MoNi$, $MoNi_3$ and $MoNi_4$, are consistently distinguished.

Introduction to nickel containing tungstate fusion of tungsten oxide (VI) has investigation a wave of renewal of ditungstate-ion:

$$W_2O_7^2 + 6e \Leftrightarrow W + WO_4^{2-} + 3O^{2-}, \qquad (6)$$

A difference in potentials of selection of nickel and tungsten is 0.130-0.160 V at temperature 1173 K, thus at a nickel is higher.

Addition to cobalt containing tungstate results fusion of tungsten oxide (VI) in appearance of wave of renewal of ditungstate-ion ion, answering reaction (6). A difference in potentials of selection of cobalt and tungsten here is 0.080-0.140 V at temperature 1173 K and unlike haloids and haloid-oxide fusions cobalt nobler than tungsten (molybdenum) in oxide fusion.

Addition to cobalt containing tungstate causes appearance of wave of renewal of ditungstate-ion fusion of molybdenum oxide (VI) of $MoO_3$, to the answering reaction (5). A difference in potentials of selection of cobalt and molybdenum here makes 0.060-0.110 В at temperature 1173 К. Depending on correlation of concentrations of $MoO_3$ and $CoO$

and cathode density of current from fusion of $Na_2WO_4$-$MoO_3$-$NiO$ can be got continuous fallouts of *Mo*, *CoMo*, $Co_3Mo$ and *Co*.

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