

Development of methods for the electropolishing of refractory metals in environmentally friendly low-temperature carbamide-containing melts.

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The investigation of Nb, Ta and Ti electrodisolution mechanisms, determination of the peculiarities of the electrochemical properties of each metal in carbamide-containing melts and analysis of passivation phenomena at the metal/melt interface were necessary for the creation of scientific approaches to the development of methods for electropolishing metals in carbamide-containing melts. For developing the methods of electropolishing Nb, Ta, Ti in carbamide- NH₄Cl melt was chosen as the main electrolyte-solvent for all metals, as environmental. The electrodes were polarized with direct, alternating and reversible current, but the best results we received by electrode polarization with reversible current. The use of organic surfactants, which are thermally, chemically and electrochemically stable under electrolysis conditions, also improved the coating quality. According to the electrochemical activity of the metals in carbamide- chloride melts, the electrochemical treatment conditions and surface quality change after treatment in the order Ti₂Nb₂Ta. Titanium was easiest to treat, and the best results after electrolysis were obtained when polishing Ti. After 5 minutes long electrochemical treatment, the titanium surface finish class increases by three orders of magnitude, and brightness reaches 84. In the case of the anodic treatment of Nb, the surface brightness reaches 74 magnitude after 10 minutes long treatment. Tantalum is more difficult to polish. In the carbamide- NH₄Cl melt, the metal should be treated for 15 minutes in this case, the surface finish class improves by only one order of magnitude, and brightness is not over 70. The surface finish class can be increased by two orders of magnitude and brightness to 80. The results obtained for the main parameters (surface finish class and brightness) correspond for all metals to the required polished surface parameters.

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