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Role of Metal Impurities in Generation of Defects in Anodic Layers of Nb2O5

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Key role in formation of the properties of the anode layers of niobium pentoxide is related to defects of their own or additive nature, while the main defects are oxygen vacancies. The aim of this work – analysis of additive influence in niobium on formation of defects in Nb2O5.

The object of the study were layers of Nb2O5, formed by anodic oxidation of the sintered niobium pellets of two types (denoted as A and B), differ by the presence on the surface of A type samples of Mg additive, controlled by X-ray photoelectron spectroscopy (XFES). It shall be noted that XFES - initial analysis of the niobium powder applied at generation of samples of both types, has shown no differences in the composition of additives; presence of Mg has only been detected on the surface of the pellets formed by high-temperature vacuum powder sintering. This fact affirms that additives located in the niobium powder as a result of sintering are concentrated on the pellet's surface probably according to the bulk diffusion mechanism. Anodic oxidation of niobium was similarly carried out in two stages: in a galvanostatic mode, and subsequent aging at a constant voltage. Concentration of charged defects is determined from the current-voltage characteristics (C - V) according to Mott -Schottky equation. The results can be interpreted as follows: at the first (galvanostatic) stage of anodic oxidation of samples part of A atoms displaced from the metal oxide pellets are represented by additive metal atoms (Mg), which behavior in electric field is determined by mechanisms specific for anionic defects. As a result, after galvanostatic stage less quantity of defects as compared to B sample case will be carried out to the oxide / electrolyte border. Further, at the transition to the potentiostatic oxidation mode, Mg2+ cations along with the basic (anionic) defects are moved to the outer boundary of the oxide layer, which leads to an increase in concentration of the charged defects in the surface layer Nb2O5.