Investigation of a Resource Aspect for Efficiency of Protective Coatings on Metal Structures of Anode Part for Molten Carbonate Fuel Cell Batteries

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Electrochemical generator on the base of high temperature molten carbonate fuel cells (MCFC) is one of the most perspective autonomic energy sources. One of the main problems, retarding the commercialization of energy MCFC plants, is low corrosion resistance of their metal structures, for the operating MCFC temperature is 600-7000, and the electrolyte is such an aggressive medium as an alkaline metal carbonate mixture. This problem is solved either through the development of new alloys either through applying of appropriate protective coatings on stainless metal structure steels. A material resistance for corrosion in a carbonate presence is defined to a large extent by a gas atmosphere above the melt, at the same time the corrosion degree in anode gas is rather higher than one in cathode gas. The aim of the work was the study of resource possibilities of economical protective coatings for different parts of separator MCFC plates. The nickel and aluminum coatings (for a sealing area), widely used as the coating variants, and also one of the perspective coatings made of titanium nitride, - were studied. The stainless steel 12H18N10T was used as the base material. The following methods were chosen of a great number of ones to apply coatings at the preliminary stage for nickel: galvanic method and the method for explosive plating; for aluminum: thermal diffusion, emulsion and gas flame sputtering methods, and for titanium nitride the method for ion bombardment condensation. The testing for serviceability of protective coatings were performed on samples during 100 hours in operation of the anode part of a separator MCFC plate (temperature 650, eutectics melt Li2/K2 CO3, gas atmosphere H2+CO2+H2O, external polarization of about 900mV). Anticorrosion properties of coatings were estimated using metallographic and gravimetric methods and also by the results of X-ray phase and X-ray spectral analyses. In the Fig. 1,2 and 3 some electron-microscope images are quoted for sections of coatings after corrosion testing. The investigation performed allows making a conclusion about high corrosion resistance in comparison with other corrosion resistance for titanium nitride coatings produced by the method of ion bombardment condensation.