DEVELOPMENT OF A COMPOSITE CORROSION-RESISTANT MATERIAL BASED ON TITANIUM FOR VESSELS OF CHEMICAL INDUSTRIES [1]

M.G. GOLKOVSKI, V.V. SAMOYLENKO**, I.A. POLYAKOV**, V.A. BATAEV**, I.K. CHAKIN*.*

** Budker Institute of Nuclear Physics, Siberian Branch of Russian Academy of Sciences, 11, Academician Lavrentiev Avenue, Novosibirsk, 630090, Russia, golkovski@mail.ru, phone: +7(383)3294250*
*** Novosibirsk State Technical University, 20, K. Marx Prospekt, Novosibirsk, 630073, Russia*

Titanium and its alloys cause an increased interest of researchers, since they advantageously combine high strength, plasticity and corrosion resistance. This makes it possible to manufacture from this material the critical parts that operate at chemical, petrochemical and nuclear industries. However, in some cases, the corrosion resistance of titanium is insufficient and the metal is actively destroyed by the action of strong acids heated to the boiling point. One of the most rational solutions to increase the corrosion resistance of titanium products under similar conditions is their surface alloying with tantalum, niobium and zirconium. This solution provides a comprehensive approach, since it allows reducing the dissolution intensity of the surface of the protected material, to retain high mechanical properties of the substrate and to save the more expensive alloying elements (Ta, Nb, Zr). As a method of depositing protective layers, the authors propose a technology for electron beam surfacing in the air atmosphere. The method possesses a high productivity, while it lacks the main drawback inherent in most electron beam facilities - the need for using a vacuum chamber. Electron-beam surface alloying of the of billets is realized on the industrial electron accelerator ELV-6 that is produced by the Budker Institute of Nuclear Physics of the Siberian Branch of Russian Academy of Science. The design features of the accelerator outlet device allow the output of a beam with high energy of electrons directly into the air atmosphere. Before processing, the powders of alloying elements and flux are applied to the surface of the protected material. Subsequent reflow by an electron beam results in a two-layer material consisting of a coating of about 2 mm thickness and a titanium substrate with a thickness of at least 8 mm. An essential feature of the method is the ability to subject the described material to such technological operations as welding, bending and rolling for necking. In the composite material, because of rolling or the thermal action of the welding arc, cracks, delaminations and other defects do not occur. Reducing the thickness of the material during the rolling operation can reach 80%.

A prototype of a corrosion-resistant reactor was manufactured from surface-alloyed flat blanks by using the technological operation of welding. It was tested using boiling concentrated nitric acid as an aggressive medium for 15 days. The test results showed that the corrosion resistance of the reactor walls coincides with the resistance of individual samples cut from the coatings after surfacing, and is about 20 μm / year. Thus, it is possible to recommend the technology of electron beam surfacing in the air atmosphere to produce vessels and tanks of enhanced corrosion resistance, in which strong acids are heated.

REFERENCES (STYLE "EFRE2018 TITLE REFERENCES")

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[2] *Bataev V.A et al. //* Applied Surface Science. – 2018. – 437. 181-189.

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