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ELECTROPHYSICAL PROCESSES IN ELECTRIC DISCHARGE REACTOR DETERMINED BY GEOMETRIC TRANSFORMATION OF ELECTRODE SYSTEM

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Consideration of the issues of destruction of the electrode systems of electric discharge reactors is of great theoretical and practical importance. The main element in the structural diagram of an electric discharge installation is an electric discharge reactor, in which final useful work is performed, for example, the synthesis of materials, the shaping of sheet metal, the emulsification of immiscible liquids, etc. [1,2].

The issues of destruction of the current conductor of a low-voltage electrode by its electrical erosion are considered. At present, the mechanism of destruction of electrode systems has been elucidated [3,4,5]. Erosion of the active element of the low-voltage electrode is caused by thermal action. There are four sources of thermal energy [5]: heat supplied to the electrode due to the bombardment of its surface with electrons (or ions); heat from flowing current; heat supplied to the electrode from radiation according to the Stephen-Boltzmann law; heat transferred to the electrode by the plasma jet. It has been established that the heat flux from the plasma jet leakage is one to three orders of magnitude greater than from all other heat sources and is the main cause of electrode destruction.

The paper considers the electrical erosion of an electrode located in a reactor filled with tap water. The source of pulsed energy is a generator of pulsed currents with a stored energy of 1.8 kJ. The pulse repetition rate is 1.5 Hz. The active element of the electrode is made of high-alloy steel 12X18H10T. The electrode was exposed to 10800 pulses, which corresponded to the operation of the installation for two hours. Figure 1 shows the active element of the electrode after exposure to electrical discharges.

Fig 1. The active element of the electrode after exposure to electrical discharges

The erosion crater looks like a semi-ellipsoid with a depth of about 10 mm. In the process of further erosion, the semi-ellipsoid tends to degenerate into the shape of a hemispheroid. It should be noted that an electric discharge in a liquid is accompanied by the appearance of cavitation processes, which are as powerful a source of perturbation as shock waves. Drawing an analogy with studies [6], we can draw an important conclusion from a practical point of view: an erosion crater in the form of a semi-ellipsoid or hemispheroid makes it possible to form cavitation phenomena in the depth of the treated liquid and thereby activate a larger volume of liquid.

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