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STUDY OF RADIO-FREQUENCY INDUCTIVELY DISCHARGE IN THE PRESENCE OF LIQUID *)

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Research into electrical discharges with liquid electrodes is one of the rapidly developing areas of science. This type of discharge is generated by direct or alternating current in the interelectrode gap, where one or both electrodes are a flowing or non-flowing liquid. As a rule, solutions of salts of various concentrations in industrial, distilled or tap water are used as a liquid electrode.

In this paper, we investigate a new type of discharge with liquid: a radiofrequency inductively coupled discharge with an electrolyte jet introduced into the discharge tube. The discharge was created in pressure range from 10^3 to 10^5 Pa at a frequency of 1.76 MHz.

The experiment was conducted as follows. A bath with a salt solution was placed in a vacuum chamber, and one end of a quartz tube with an internal diameter of 22 mm and an external diameter of 28 mm was lowered into the bath. A copper strip was wound onto the quartz tube, forming a three-turn solenoid.

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Fig. 1. Combustion of a radiofrequency inductively coupled discharge with a jet of 3% $(NH_4)_2SO_4$ solution in the discharge tube: a) $U_{discharge}$=0.38 kV, $I_{discharge}$=0.16 A; b) $U_{discharge}$=0.68 kV, $I_{discharge}$=0.34 A.

A jet of electrolyte with a diameter of 1 mm was fed into the tube through the tube upper end using a special device. The distance from the outlet of the feeding device to the electrolyte surface in the bath was 40 mm. The flow rate of the electrolyte was adjusted so that the jet flowed down in a continuous stream without the formation of a drop phase. A voltage of 300 to 900 V was applied to the solenoid, the discharge current was from 0.1 to 0.5 A.

Various forms of discharge combustion were studied. At a low input power, the discharge burns in the lower part of the jet, where it merges with the electrolyte in the bath (Fig. 1). As the power increases, the discharge fills the lower part of the discharge tube, forming several channels (Fig. 2). With a further increase in power, a breakdown occurs between the inductor and the electrolyte in the bath, which leads to the inductor melting.

The results of the study of the characteristics of the discharges are presented.

References

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