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ALTERNATING CURRENT DISCHARGES IN A SOLUTION OF COPPER SULFATE *)

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The electric discharge-electrolyte system is a multiphase medium consisting of plasma, electrolyte, and gas bubbles. The study of electrolyte-plasma discharges is of scientific and practical interest [1-4]. Physical processes such as breakdown phenomena, shock waves, heat generation, convection, vaporization, condensation of water, etc. occur in discharges in a liquid. The purpose of this work is to establish electrical characteristics and identify the features of physical processes occurring in an alternating current electric discharge in the "electric discharge- electrolyte" system. The study of alternating current electric discharges with a frequency of 50 Hz was carried out at atmospheric pressure in the range of discharge voltage 10-1300 V and discharge current 0.01-0.55 A, interelectrode distance of 50 mm and 150 mm, diameter of a dielectric tube of 10 mm. The experimental setup consists of an alternating current power supply and a discharge chamber. The discharge was generated in an arc-shaped dielectric tube with two electrodes at different ends of a tube filled with electrolyte. A one percent solution of copper sulfate in distilled water was used as the electrolyte. The volt-ampere characteristics, volt-second and ampere-second dependences of the alternating current discharge are studied. It is established that over time, the discharge voltage varies exponentially or abruptly depending on the interelectrode distance, electrolyte concentration and interelectrode distance. After switching on the electrode power supply, the electrolysis process begins and the formation of bubbles of various shapes and sizes is observed on the surface of the electrodes. The breakdown after electrolysis generates a shock wave in a gas-liquid medium and ignition of the discharge. This leads to turbulent mixing and crushing of air bubbles in a gas-liquid medium. A number of breakdown phenomena have been established in the process of discharge development, which form shock waves leading to rapid mixing of air bubbles. With an increase in the interelectrode distance from 50 to 100 mm, the stability and discharge current decreases, and the discharge voltage increases stepwise or abruptly over time. To identify the frequency spectrum of voltage and discharge current fluctuations, a fast Fourier transform was performed, obtained from voltage and discharge current fluctuations. From the analysis of Fourier spectra and oscillograms of voltage and current, it follows that the most predominant frequencies of the spectrum for voltage are 50 Hz, and for current 50, 150 and 250 Hz. With an increase in the conductivity of the solution (3% copper sulfate), the frequencies of 350 and 450 Hz with a low intensity are supplemented for current.

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