The hydrodynamic instability of the liquid phase in the process of multichannel discharge burning

Lilia Bagautdinova[1], Fivzat Gaisin[1], Shamil Mastjukov[1], Eduard Son[2]

Kazan State Technical University nam. A.N. Tupolev, Kazan, lilup@bk.ru (1),
Moscow Institute for Physics and Technology, Moscow, Russia, edson44@mail.ru (2)

The understanding of the physics of plasma-liquid interaction remains quite limited due to complicated dynamic nature of the plasma-liquid boundary. Electric discharges between metal anode and 5 – 15% water solutions of ammonium sulfate (cathode) are investigated in this work. The pictures of multichannel discharge on the anode immersed to electrolyte at atmospheric pressure were obtained. The negative potential was supplied by a flat plate shaped electrode; the anode was a cylindrical rod with small surface.

The photos show that there are various phases of the process: the electrolysis, the formation of a stable gas-vapor shell, the transition of the multichannel discharge to turbulent regime with intense mixing of plasma and electrolyte. The pictures of various stages of turbulent mixing of multichannel discharge and electrolyte (so called hydrodynamic regime) with intense electrolyte evaporation and sprays are presented. Due to intense turbulence the electrolyte is chaotically moving near the metal electrolyte. The gas-vapor shell is periodically collapsed and the discharge is interrupted.

It is established that the discharge can cause a significant hydrodynamic instability both on the surface and inside the electrolyte.