EVOLUTION OF DISCHARGE CHANNEL IN IPA SOLUTION
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Discharges in liquids are used in various fields of human activity, such as medicine (extracorporeal shock wave lithotripsy), construction (electrohydrodraulic machine and reuse of construction materials), and ecology (eliminating bacterial, organic and inorganic impurities). Many researches have been done on discharges in liquids with variety of electrode sets. In this paper we report observation of the pulse discharge channel propagation after its initiation in 15% IPA solution.

In our experiment, stainless still (anode) and copper (cathode) electrodes are placed in the vertically oriented 16.6-mm inner diameter quartz tube with anode electrode at the top. The anode tip has a conical shape with apex angle of 20° and cone basis diameter of 3 mm. The cathode tip has a hemisphere shape with radius of 1 mm. The electrode gap is 15 mm. High voltage pulse voltage generator (HVPVG) with inner storage capacitor of 1.6 mcF and (0-40) kV output voltage is used for spark generation. Half amplitude pulse duration is about 10 ms. Ballast resistance limits current value less than 3A. Voltage and current across the discharge gap are measured by Tektronix DPO7054C with high voltage probe and current shunt respectively. The applied voltage pulse has positive polarity. The discharge is synchronized with the CMOS RedLake MotioPro X3 camera. The results of the experiment revealed the following phenomena. The anode region glowing appears in (500-600) mcs after voltage applying due to ionization-overheating instability near the surface of anode electrode. Obtained images show channel developing from this region. Partial discharges are observed in the near region along the whole length of the channel during its evolution. These discharges most likely occur in gas bubbles. Their formation due to vaporization during the Joule heating of highly volatile fraction with conduction currents was observed in subsidiary experiment without electrical breakdown of the electrode gap. Bubble breakdown in front of channel tip was observed. The channel reaches cathode in 4 ms after the anode glowing appearance. The propagation velocity is about 4 m/s. After the gap is bridged the discharge channel heats up and intensive cathode glowing appears. The most of energy deposits in the cathode region. The destruction of spark channel takes about 2 ms. After the discharge current drops anode glowing almost disappears opposite to cathode glowing with additional (4-5) ms life-time.