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CREATION OF CHARGED MACROSCOPIC PARTICLES IN A CAPILLARY DISCHARGE IN AIR *)

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Experiments have been carried out to obtain long-lived luminous formations—plasmoids in the interaction of a capillary plasma generator's jet with samples of steel, copper, tin and solder. The design of the capillary plasma torch has a standard form [1].

The energy inputted in the discharge varied from 0.3 to 1.5 kJ. In contrast to the experiments [1], a high voltage of 10–13 kV was applied to the samples. At higher voltages a breakdown to the plasma generator occurred.

In the absence of high voltage, the interaction of the capillary plasma generator's jet with metals resulted in the formation of compact long-lived luminous formations - plasmoids. When exposed to solder, objects with unusually large external diameter up to 1.5 cm, shell cover of about 10 μm and lifetime up to 7 s were obtained. The objects consisted of a core and shell and had an energy density comparable to the energy density of combustible materials. These objects directly fall down and leave traces of interaction on the surface of the paper in the form of charred points of trajectories and traces of explosions (star-shaped).

When applying high voltage to the samples during the interaction of the capillary plasma torch jet with metals, the formation of compact long-lived luminous formations also occurred. However, their life time was increasing. Part of the plasmoids did not directly fall as in the absence of applied voltage, but continued to move along a complex trajectory, extinguishing or exploding in the air. When falling to the surface, these plasmoids continued to jump a long distance (several cm) and then went out.

These facts indicate the creation of unipolar charged plasmoids in which there is a shell and a core of molten (vaporized) metal. At the same time, the presence of a charge leads both to an increase in the lifetime of the plasmoid and to the hardening of its shell. According to these properties, the created plasmoids are similar to ball lightning of natural origin.

References

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