Vacuum Arc Explosive Electron Emission Cell Ignition and Sustainment at Fine-Structure Surface and External Action

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Vacuum discharge implies a formation of plasma from the electrode material for a large current transfer. It consists of three stages – vacuum breakdown, vacuum spark, and final – vacuum arc [1]. The basic feature of all these stages – explosive electron emission (EEE) pulses – ectons that arise from microcenters at the cathode – cathode-spot cells, and are responsible for an electron emission current of a large density and large magnitude [2-3].

It has been found that external action of intense energy flux as well as the surface microstructure promotes the ignition of the new explosive cells [4-5].

Present work is intended to present results on the following issues. The buildup of a strong electric field due to the cell-current decay at the cell extinction phase. Liquid-metal plasma jets expansion and their tearing that results in the electrical explosion ignition of these jets. Influence of the magnetic field (external to the active cell) on the new cell ignition that results from a space charge redistribution.

Work was supported in part by RFBR grants #13-08-01397, #14-02-00575, #14-08-01137, and Russian Academy of Sciences under Basic Research Program.

[1] G. A. Mesyats and D. I. Proskurovsky 1989 Pulsed Electrical Discharge in Vacuum (Berlin: Springer Verlag)
[2] A. Anders 2008 Cathodic Arcs. From Fractal Spots to Energetic Condensation (Springer Science + Business Media, LLC, New York, NY)
[3] G. A. Mesyats, *IEEE Trans. Plasma Sci.* **41** 676-694 (2013), IEEE Marie Sklodowska-Curie Award 2012 Lecture 'Ecton Mechanism of the Cathode Spot Phenomena in a Vacuum Arc', 39th ICOPS Edinburgh, UK
[4] S. A. Barengolts, G. A. Mesyats, and M. M. Tsventoukh, 2008 *JETP* **107** 1039 [2008 *Zh. Eksp. Teor. Fiz.* **134** 1213]
[5] S. A. Barengolts, G. A. Mesyats, and M. M. Tsventoukh 2010 *Nucl. Fusion* **50** 125004