C1-O-031701

MULTIARC GRID PLASMA EMITTER BASED ON AN ARC DISCHARGE FOR GENERATING A RADIALLY CONVERGING ELECTRON BEAM

M.S. TORBA, M.S. VOROBYOV, N.N. KOVAL, V.V. EZHOV, S.YU. DOROSHKEVICH, S.A. SULAKSHIN

Institute of High Current Electronics, Tomsk, Russian Federation

The promise of using electron sources with a plasma cathode based on a low-pressure arc discharge with grid/layer stabilization of the emission plasma boundary, and a plasma anode with an open plasma boundary, has been repeatedly demonstrated for surface modification of various materials and products, leading to a multiple improvement in the functional properties of their surface, modifications of the surface of materials that are unattainable by other means, which clearly confirms the need for further development and implementation of equipment of this class. However, the complexity of the shape of most processed products hinders the introduction of such equipment in a specific technological process. That is why in this work we study a grid plasma emitter for generating a radially converging electron beam, suitable for modifying the surface of products not only cylindrical, but also of a more complex shape (for example, processing stents) [1,2].

Thus, this paper describes the design of a grid plasma emitter based on a low-pressure (~10-2 Pa) multi-arc discharge for generating a radially converging submillisecond electron beam [3,4]. The developed and created power supply system based on inductive energy storage devices makes it possible to generate arc discharge current pulses of submillisecond duration with an amplitude of up to 200 A. The conducted studies of the generation of emission plasma allow us to assert that this method of generating an electron beam is promising for scientific and industrial purposes when processing products of complex shape, or generating microwave radiation.

REFERENCES

[1] V. E. Gromov, F. Y. Ivanov, S. V. Vorobiev, and S. V. Konovalov, Fatigue of Steels Modified by High Intensity Electron Beams. Cambridge, U.K., 2015, p. 272.

[2] E. Oks, Plasma Cathode Electron Sources: Physics, Technology, Applications. Hoboken, NJ, USA: Wiley, 2006, p. 171.

[3] Koval. N.N., Grigoryev S.V., Devyatkov V.N., et al. // IEEE Trans. Plasma Sci. -2009. – V.37.- No. 10. – P.1890-1896.

[4] Vorobyov M.S., Gamermaister S.A., Devyatkov V.N., et al. // Tech. Phys. Lett. – 2014. –V.40.-No.6.-P.526-528.