MORPHOLOGICAL ANALYSIS OF SURFACES OF THORIATED AND YTTRIATED TUNGSTEN CATHODS IN ATMOSPHERIC PRESSURE ARC DISCHARGES

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A plasmatron with observation windows was developed for conducting spectroscopic and pyrometric studies of the cathode and cathode plasma [1] in real time.

The studies were carried out after reaching the stationary mode of operation of the plasmatron in an argon medium (plasma-forming gas flow rate of 1–2 g/s) at atmospheric pressure and currents of 100–300 A. For the cathode materials, Yttriated tungsten with a Y2O3 content of not more than 2% was used (W – 2% Y2O3), and thoriated tungsten with a ThO2 content of not more than 5% (W – 5% ThO2).

This study aims to identify patterns of structural changes on the surface of the cathodes in different modes of operation of the plasmatron [2]. For this, a series of identical cathodes was made from each material (W – 2% Y2O3, W – 5% ThO2) on which experiments were conducted with different activation duration (from 10 minutes to 1 hour).

After testing, the cathodes were placed under an electron microscope. Images obtained from a microscope allow us to determine changes in the morphological structure on the surface of the samples. Also during the filming of the cathodes’ tips the composition of the material was analyzed on the surface of the cathodes using energy dispersive X-ray spectroscopy. The result of these measurements was the exact determination of the arc binding area, and it was also possible to determine the zone of impurity deposition at a certain distance from the arc binding zone.

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References

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2. Sillero J.A., Ortega D., Munoz-Serrano E. and Casado E. 2010 J. Phys. D: Appl. Phys., 43 185204.