Investigation of electric-erosion processes on the electrodes of alternating current plasma torches

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Abstract: The paper deals with investigation of electric-erosion processes on the electrodes of the plasma torches with various power. Different technologies of electrodes production are studied, tested and the results are represented and discussed in the paper.

Keywords: erosion, electrode, plasma, gasification, plasma torch

1. General

The paper deals with investigation of electric-erosion processes on the electrodes of the plasma torches with various power.

These plasma torches are used in systems with plasma chemical reactors [1] and they are widely used for plasma gasification of different organic containing substances including for syngas production. The long life time of electrodes is very important for reliable operation of the plasma torches.

The paper describes different methods of electrodes production using various composition of materials [2]. Measurements are made in a zone of the highest electrode wear - in a place of an arc attachment [3]. Determination of the wear rate (specific erosion) is made including the statistical data of the length change of the electrode working part.

The system of continuous determination of electrode erosion in the process of alternating current plasma torch operation is investigated. The system does not demand the engineering change in the plasma torch and the plasma chemical reactor. The system allows doing the integrated study of the specific erosion behaviour depending on the cooling mode, sort of the plasma-forming gas and its flow rate.

Permanent diagnostics of an electrode condition when in service and precise determination of the moment of its fracture initiation relating to the production prototypes of plasma torches and to the perspective ones is possible [4].

2. References


The plasma torches, constructed on the basis of the circuits proposed by Birkeland and Eide, Pauling and Siebert used alternating current. In the systems constructed by Sencher, a direct current electric arc 7 m long burnt in a vertical pipe blown with air. vi torches and electric arc reactors; with increasing the operating life of electrodes (the most heavily thermally stressed the sections of the plasma torches) by 1â€“2 orders of magnitude, i.e. by increasing the duration of continuous service of plasma torches to many hundreds or even thousands of hours; increasing the thermal efficiency; ap- plication of working gases of different chemical composition, tak- ing into account the specific features of the technological process and ensuring the maximum extraction of the target product. The features of alternating current plasma torches with rod electrodes and the phenomena and regularities observed during their work in a wide power range of 0.1â€“7 MW are considered. The mechanism of the reignition of the arc in the single-phase and three-phase working modes of a plasma torch is studied. The characteristic differences of these processes, the existence of which is explained by the conservation of the concentration of current carriers in the interelectrode gap in the three-phase mode, are given. It is shown that the reignition voltage varies in accordance with the variation of the temperature of the electrode surface, and the electrode temperature saturated with the increase in the current and the reinaion voltage is constant. Electrodes of alternating current single-phase plasma torches and materials for their manufacture. / Kuznetsov V.E., Kiselev A.A., Ovchinnikov R.V., Dudnik Yu.D. // Scientific and technical statements of the St. Petersburg State Polytechnic University. Physics and Mathematics. 2012. â„– 2 (146). P. 100â€“104. Study of ways to increase the life time of rod-type electrodes and the time of continuous operation of high-voltage electric arc alternating current plasma torches with power from 5 to 50 kW. / Kuznetsov VE, Ovchinnikov RV, Spodobin VA, Shiryaev VN, Nikonov AV, Lukyanov SA, Vasilieva OB. // I... Processing and characterization of plasma spray coatings of. Industrial waste and low grade ore mineral on metal substrates. Thesis submitted in partial fulfillment of the requirement for the. The erosion wear behaviour of these coatings is evaluated with angular solid particle erosion tests under various operating conditions. In order to optimize the surface property for different application, one of the challenges is to recognize parameter interdependencies; correlations and their individual effects on process so that the coating can be useful for a specific application. natural oxide layer on the surface of metal parts. In this process the part to be treated forms the anode electrode of an electrical circuit.