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FORMATION OF PULSED PLASMA FOCUS FLOWS FOR PROCESSING INTERNAL SURFACES OF TUBULAR PRODUCTS *)

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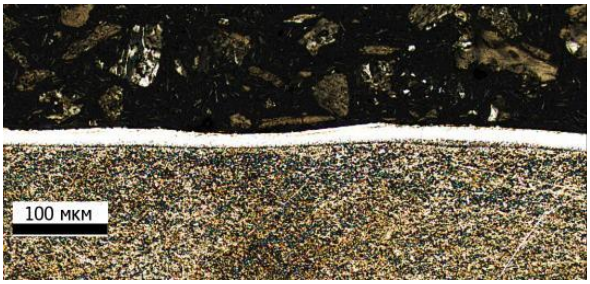
Experiments on the effect of plasma focus system discharge on the surface of metal products are in most cases episodic. However, the experimental modeling of “plasma jets” [1], accompanied by the generation of high-speed (>100 km/s) directed plasma formations that spread over significant (~1 m) distances from the electrodes of setups, is directly related to this issue. In our experiments performed on the PF-MOL setup [2], on steel samples located 200 mm from the current sheath focusing point, the density of heat flows absorbed by the surface was measured to be 15-17 J/cm^2. This is sufficient for remelting a 5-10 μm layer with rapid quenching at an irradiation pulse duration of 7-10 μs. A photo of a cross-section of one of the samples is shown in the first foto. For



40KhMFA steel, the surface microhardness increased by 2.5 times from 350 to 900-1000 units according to Vickers. In the experiments conducted, the working medium of the current shell (Helium, Nitrogen, Neon), the charging voltage of the capacitive storage and the number of discharge pulses were varied. We set out to find an approach to treat the inner surface of tubular products with diameters up to 60 mm, which the observed 90 mm diameter of the generated flux allowed us to hope for. Geometrically similar small-scale focus plasma treatment experiments were attempted previously [3], but in those experiments the main effect was the deposition of additional coating layers. The cathode nozzle shown in the second photo was fabricated for tubular experiments. The cathode busbar configuration is chosen similar to the geometry of the current shell defined in [2]. At the same time, the nozzle concentrates the plasma flow at the tube inlet, the main part of which in the usual Mather geometry continues unperturbed movement along the axis. The replaceable samples under study are placed in special grooves of the tube. As an additional measure, the tube is provided with a conical insert, a plasma flow splitter, deflecting the flow velocity vector in the radial direction. The results obtained in different modes of the setup operation are discussed.

References

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