Special Interest Group Meeting: Structured & Freeform Surfaces, University of Huddersfield, UK, 28th – 30th September 2022 www.euspen.eu

Validation of the oxide layer quality of surface-modified tool electrodes by EDM-drilling process

E. Uhlmann[1,2], C. Hein[1], J. Streckenbach[2], M. Polte[2], J. Börnstein[1], E. Dargin[1]

[1]*Fraunhofer Institute for Productionsystems and Design Technology IPK, Germany*

[2]*Institute for Machine Tools and Factory Management IWF, Technical University Berlin, Germany*

emre.dargin@ipk.fraunhofer.de

Abstract

Electrical discharge machining (EDM) is used for force free machining of electrically conductive materials. The process is used to produce high-precision contours and micro-holes in extremely high-strength materials, and is therefore used and highly valued by many industry sectors. In particular, for example, the aerospace industry uses the process to create several hundred cooling holes for turbine blades. A reduction of time and material costs within the manufacturing process would lead to a significant cost reduction in the machining of turbine blades. The requirement for the holes produced for this is that they are extremely contour-accurate and reproducible. Side discharges occur along the surface of the tool electrode during drilling and prevent precision and reproducibility. As the aspect ratio increases, the probability of side discharges also increases, which negatively affects the process.

To solve this problem, a new technology was applied, based on the oxidation of the tool electrodes to reduce the electrical conductivity of the surface. For this purpose, the electrodes were subjected to liquid chemical and thermal treatment to isolate the surface. In order to obtain information about the quality of the oxide layer drilling experiments were conducted. For this, the erosion time was recorded and the tool electrode wear was measured. In addition, the bores produced were compared with each other in terms of contour accuracy, reproducibility and surface roughness. Based on the investigations, a reduction of 8 % for the erosion time and 5 % for the tool electrode wear could be achieved.

EDM-drilling, tool electrodes, surface modification