INVESTIGATION AND MODELLING OF WEAR OF NATURAL MONOCRYSTALLINE DIAMOND CUTTING TOOL

S.N. Lavrynenko[1], M. Rucki[2], P. Andralojc[2], A.G. Mamalis[3]

[1]National Technical University "Kh.P.I.", Kharkov, Ukraine; [2]Poznan University of Technology, Poland; [3]National Technical University of Athens, Greece

This paper is a continuation of long duration research and it reports about new results in the investigation of wear of natural monocrystalline diamond cutting tool in single-point precision and ultraprecision machining processes of vitreous thermoplastic amorphous polymeric materials for various application, e.g. for bioengineering and photon-optical applications. In these investigations we have been using up-to-date methods and devices, including Atomic Force Microscope, interferometers and optical profilers, 3D Topographic Analysis Systems, optical-polarizable microscope, etc.[1]. Wear criterions were chosen as the technological criterion of the diamond tool cutting wedge clearance face wear, criterion of temperature rise and criterion of cut surface deterioration. The compulsory replacement of cutting tool on reaching of appointed value of wear allows to provide high quality level of the machined surfaces of articles from polymers and their long durability.

The precision and ultraprecision single-point diamond cutting is the most effective process for generation of high quality functional surfaces with minimal defects in the superficial surface layer. The investigation of the basic features of the micromechanics of cutting tool wear as result of the interaction between cutting wedge and work-piece in the process of controllable directed fracture of the processed material with new functional surfaces generation is the extremely important task, which will be allowing to control quality of the functional characteristics of surface already in the manufacturing process and for finished articles too. As result well-timed replacement or accurate regrinding and finishing of diamond cutting tool provides for stability of surface quality characteristics and increase of functional characteristics and durability of finished articles. Also results of this investigation and modeling can help in production of the high-effective cutting tools and lower cost for their regrinding.

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