

## EFFECT OF TREATMENT WITH FAST ARGON ATOM BEAMS ON THE FRACTURE RESISTANCE OF THE SURFACE LAYER OF OXIDE AND NITRIDE TOOL CERAMICS\*

M.A. VOLOSOVA<sup>1</sup>, A.E. SELEZNEV<sup>1</sup>

<sup>1</sup>Moscow State Technological University "STANKIN", Moscow, Russia

The purpose of this study is to investigate the effect of fast argon atom beam treatment at gas pressure 0.1 Pa, discharge current 2 A and accelerating voltage 4 keV on the fracture resistance of the surface layer of tool ceramics – Al<sub>2</sub>O<sub>3</sub>/TiC and SiAlON. The particles beam treatment technology was developed to remove the defect layer that is always formed when diamond grinding ceramic cutting inserts. Grinding is necessary for sharpening cutting edges and is the finishing stage of the manufacturing process. The formation of a distinctive defect layer often leads to an intensification of the cutting edge fracture process of ceramic inserts during the machining. It may be assumed that effective removal of the defect layer significantly increases the fracture resistance of the surface layer of ceramic specimens near the cutting edge. Commercially available round ceramic inserts with a diameter of 19.05 mm and a height of 7.9 mm were used for the experiments. The particles beam treatment was carried out for 2 hours. At the selected treatment conditions the thickness of the removed defective layer differed for the investigated tool ceramics and amounted to: for SiAlON - 10 μm; for Al<sub>2</sub>O<sub>3</sub>/TiC - 12 μm. The SEM-images of the surface layer of the tool ceramics - initial (1) and after particles beam treatment (2) presented in Fig. 1 illustrate the changes involved.

Fracture resistance of tool ceramics (original and after particles beam treatment) was measured according to an original technique. Using a QNESS Q30 automatic micro-hardness tester, a diamond indenter was forcefully pushed onto the surface layer of round ceramic inserts near the cutting edge (Fig. 2).

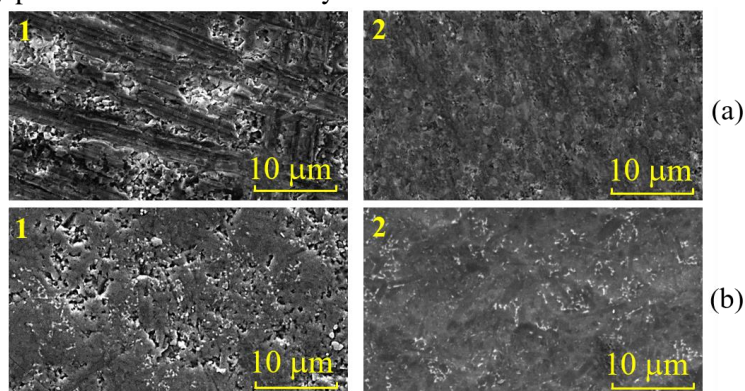


Fig.1. SEM-images of the surface of Al<sub>2</sub>O<sub>3</sub> (a) and SiAlON (b) ceramics.

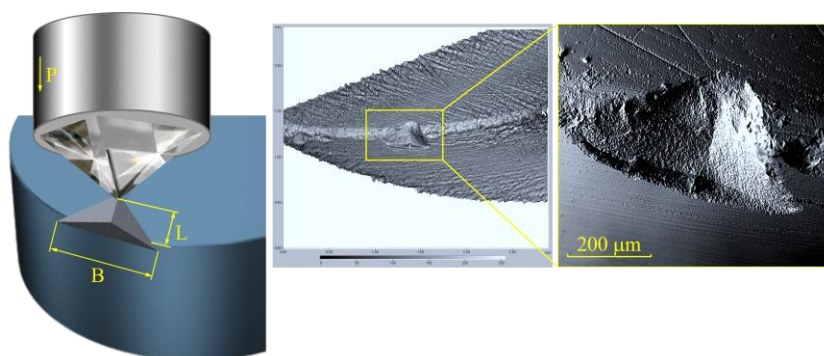


Fig.2. Technique for measuring the fracture resistance of tool ceramics.

The results of experimental investigations showed that the proposed technology of fast argon atom beam treatment significantly increases the critical load at which the area at the cutting edge is fractured. In the case of identical loads on ceramic specimens, the size of the spalling area is significantly reduced.

\* This work was supported financially by the Ministry of Science and Higher Education of the Russian Federation (project No 0707-2020-0025).