

SIMULATION OF THE EFFECT OF SINTERING ON THE QUALITY OF DIAMOND GRINDING WHEELS

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3D modeling of the fragment of the diamond layer was performed using SolidWorks and models were imported to Abaqus Unified FEA product to analyse the stress-strain state of the diamond layer. The work was based on the fundamental principles of the theory of cutting of materials; heat conduction theory and mechanics of failure. Planning of the model experiments and processing of their results were performed on the basis of the theory of a multifactorial experiment.

The basic assumption in the simulation of the sintering process was select the fragment of the diamond layer in the form of a cube with a number of diamond grains, bounded on all sides, which is fully possible to approximate the diamond wheel in general

Depending on the considered granularity the grain sizes ranged from 50x30x30 to 500x300x300 microns, grain modeled in the form of octahedrons - is the most approximate to the real shape. The presence of metal inclusions in diamond grains simulated with randomly oriented plates, which volume ranged from 5% to 20%. Considering having one or two metal inclusions located on the periphery of grain. Binder is represented as a cubic fragment of a size of 0,5x0,5x0,5 to 3x3x3mm depending on the size and concentration of the grains, as well as to reduce the influence stresses caused by the boundary conditions (fixing cubic binder in space). Coatings on diamond grains are presented in the form of a solid shell which repeats the shape of the grain. In calculations the coating thickness varied from 15 to 50 microns.

During the simulation of the stress strain state of the elements of the sintering zone, the model is initialised with a static uniformly distributed load in the form of pressure. The model takes into account heating from room temperature to the maximum sintering temperature and cooling back to room temperature. This corresponds to the process parameters of sintering.

This paper discusses the problem of the use of metal binders for diamond wheels in the range of processing speeds of 100-200 m/s. This decision is based on the possibility of using a wide range of metals (the main component of binder, as well as the use of metal binders is one of the most prevalent technologies in the manufacture of diamond wheels in Ukraine. In the same metal binder cover a wide range of processing speeds.