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USE OF TECHNOLOGICAL FLUIDS COOLANTS IN CUTTING PROCESSING

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Abstract. This paper analyzes data from theoretical studies of the influence of lubricating and cooling process media on the durability of blade tools with mechanically fastened plates and a closed cooling circuit.
Key words: cutting tool, technological environment, lubricating coolants, cooling, load capacity, durability, closed circuit, temperature, turning tool.

In modern mechanical engineering, the problem of increasing the resistance characteristics of blade tools when processing metals remains relevant. One of the ways to improve the machinability of materials is the use of technological media. Cooling lubricants help improve the quality of the machined surface and increase the reliability and durability of the cutting tool [1-3]. Increasing the durability characteristics of the cutting tool, as well as improving the cleanliness of the machined surface and increasing the accuracy of processing is the most important and pressing problem, the successful solution of which determines the efficiency of mechanical processing of materials, which can be achieved by using various methods of supplying lubricating and cooling technological media [4].

The purpose of this work is to increase the resistance characteristics of blade tools under continuous turning conditions by using cooling process fluids in a cutter with a closed cooling circuit.

Today, the most common two methods of using cutting fluids during turning are: supplying process fluids directly to the cutting zone and using process fluids in closed circuits of a cutting tool.

Depending on the specific cutting process and the material of the workpieces being processed, a certain ratio between lubricating and cooling properties is selected (about 60% of the heat is due to metal deformation, and 40% is due to friction). The degree of friction reduction is determined by the lubricating properties of the oil, and the cooling efficiency depends on the addition of water, which forms an emulsion or solution with the oil [3-5].

The most commonly used (about 95%) are oil-based fluids (based on mineral oils with the addition of additives); emulsifiers (which are mixtures of mineral oils, emulsifiers, anti-wear and extreme pressure additives, etc.); synthetic liquids formed on the basis of water-soluble polymers; semi-liquid and plastic compositions. The variety of material properties of tools and workpieces determines different requirements for technological environments.

When processing with a blade tool under turning conditions, the supply of cutting fluids to the cutting zone is carried out in the following main ways:

1). Freely falling jet (watering at a pressure of 0.02 - 0.03 MPa.

2). Under pressure through nozzle attachments (pressure jet under pressure 0.1–
2.5 MPa).

3). In a sprayed state (in the form of a jet of air-liquid mixture).

One of the least studied is the method of supplying coolant through channels in the tool without exiting into the cutting zone under pressure.

This method makes it possible to improve environmental characteristics since there is no pollution of the environment and the workplace due to the recirculation of liquid inside the channels of the tool, ensure fire safety, eliminate poisoning by vapors of chemicals included in the composition of lubricating and cooling technological media, and also virtually eliminate the loss of coolant, which allows achieve significant financial savings. [5-10].

The operational reliability and durability of a cutting tool is significantly determined by the cutting temperature. When studying the laws of the wear process of a tool blade, both the average temperature at its contact areas and the temperature value at each point of the edge are important, and therefore, it is advisable to study the laws of temperature distribution on the front surface of the edge depending on the parameters of the tool. The temperature field on the front surface of the edge arises under the influence of a rectangular heat source at regular intervals, distributed at the contact area of the blade with the front surface during steady heat exchange, which can be described using the source method using the expression: [11, 12]

$$\Theta(x,z) = K(\beta)\frac{ql}{4\pi\lambda}T(\psi,\zeta)$$

$$T(\psi,\zeta) = \int_0^l d\psi_u \int_{-0.5b}^{+0.5b} \frac{d\zeta_u}{\sqrt{(\psi-\psi_u)^2+(\zeta-\zeta_u)^2}}$$

Analysis of theoretical and experimental studies has shown that when using lubricating technological cooling media in a closed circuit of a cutting tool, using the example of a turning cutter with mechanical fastening of replaceable plates, it is possible to achieve uniform heat removal from the cutting part of the blade due to the constant circulation of liquid with a given temperature along the channel, which made it possible to increase the wear resistance of the cutting tool by more than 1.5 times due to the reduction of vibrations, since the technological environment is a vibration insulator, as well as to reduce and stabilize the temperature of the cutting tool, reduce the time for processing the part, significantly reduce the consumption of technological materials, and also improve the machinability group material.

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Анотація. У даній роботі проаналізовані дані теоретичних досліджень впливу мастильно-охолоджувальних технологічних середовищ на довговічність лезвійних інструментів, що оснащені механічним закріпленням пластинам та замкнутим контуром охолодження.

Ключові слова: різальний інструмент, технологічне середовище, ЗОР, охолодження, навантажувальна здатність, довговічність, замкнутий контур, температура, токарний різець