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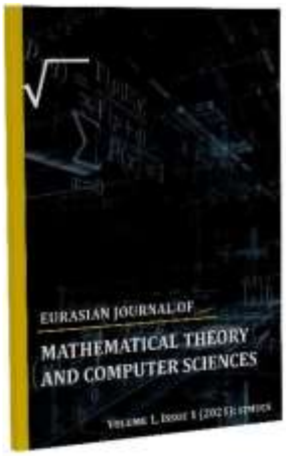

IMPROVE THE EFFICIENCY OF TURNING LIGHT ALLOYS

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ABSTRACT

the article deals with modern methods of improving the efficiency of processing light alloys based on the method of high-speed cutting, which occupies a leading place in the field of improving the performance of technological systems.

In modern mechanical engineering, the use of light alloys as structural materials for the manufacture of parts of equipment, instruments and apparatus in special and general mechanical engineering is a significant conquest of scientific and technical thought and an essential step towards the progress of mechanical engineering. In this regard, solving the problems of expanding the use of light alloys in mechanical engineering through the search for new specific applications of it for machine parts or by improving the methods of production and processing of this metal is of very great practical and scientific importance.

The process of turning aluminum in its pure form is a complex process and requires a significant investment of labor time. Mechanical processing of aluminum alloys with a high silicon content affects the increased wear of carbide metal cutting tools. The solution to these problems is achieved by using diamond cutting tools, which provide, along with high cutting speeds, an increase in productivity and quality of machining of aluminum alloys.

Features of diamond cutting are largely determined by the properties of diamond tools. High hardness, heat resistance, good polish ability, diamond cutting tools determine the possibility of obtaining the maximum sharpness of the cutting edge, providing a low roughness of the machined surface of aluminum alloys.

Technological processes of high-performance processing of aluminum alloys with diamond metal-cutting tools for a number of contact and thermomechanical processes have cumulative cutting phenomena with processing with hard alloy tools. But there are some features that distinguish these cutting processes. These features are represented by various cutting speeds, friction coefficients and sections of the cut allowance. A significant factor in increasing the productivity of machining of light alloys is an increase in the cutting speed and machining by cutting aluminum alloys is provided by the high-speed machining mode.

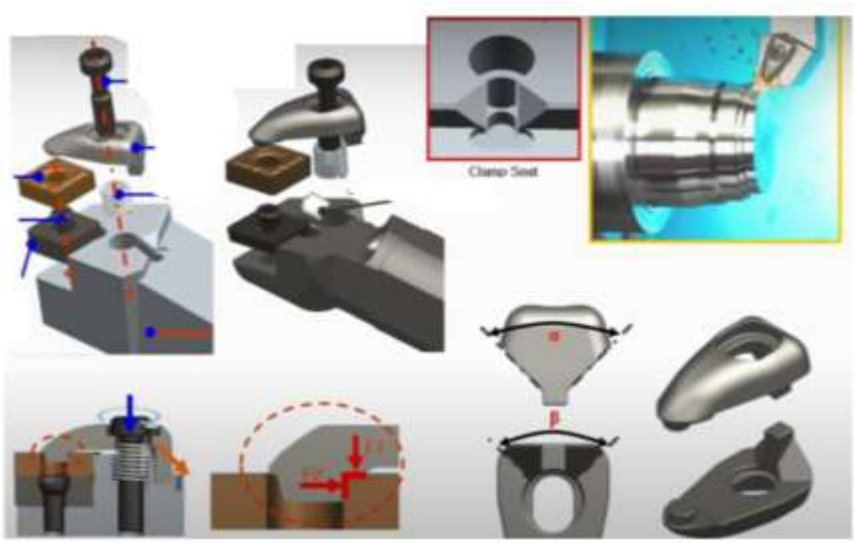

Fig.1. high-speed machining modes.

Taking into account the analysis of the stability problems of machining, it has been determined that the technological processes of cutting light alloys are complex dynamic subsystems, the reactions of which to changes in input actions cannot be predicted identically without conducting special studies. The sources of defining manifestations of instabilities during turning are the decrease in the cutting properties of tools in operation, which significantly affect the growth of the energy intensity of the processes that have arisen with changes in the cutting forces and temperatures in the processing zones.

Turning processes of titanium alloys are determined by a number of processing features. Titanium alloys are difficult-to-machine materials for machining. The essential motives for the low machinability of titanium alloys are significant efforts and high temperatures in the cutting zones, which determine a significant effect on machinability. Changes in the cut layer in the cutting zone occur depending on the cutting conditions, the geometry of the turning tool, and the delivery rate of the lubricating coolant.

In contrast to the processing of carbon and low-alloy structural steels, the processing of difficult-to-machine materials exhibit maximum cutting forces and more significant vibrations. Along with this, there is increased heat generation and maximum temperature on the contact surfaces with the tool. The factor of increasing temperature determines a decrease in the hardness of the surface layers of tools, an increase in the phenomena of diffusion, an increase in the destruction of the working edges of the blades. This significantly determines the impossibility of using productive modes of processing, intensive wear of tools and an increase in the labor intensity of machining.

Taking into account these features, the technological processes of cutting titanium alloys have the following picture: in the initial period, the working surface of the cutter has contact with a relatively plastic metal, causes plastic deformation of the cut layer, accompanying the maximum consumption of the energy applied by the tool. The cut-off stock gains maximum hardening and achieves the properties of work-hardened metals.

The performed research and analysis of production activities have determined that the types of machining and operating parameters of cutting conditions demonstrate a significant effect on the strength properties of parts made of titanium alloys. Taking into account the specificity of processing titanium alloys, high requirements for heat resistance and strength are determined for processing tools. High speed steel and cemented carbide are the main tool materials for titanium-based alloys processing, providing their high-performance machining.

Taking into account the conducted studies of the thermos physics of the processes of high-speed processing of titanium alloys with cooling the surface of the part with liquid nitrogen, an optimal solution was determined for improving the technological process of machining titanium alloys by increasing labor productivity in the processing of titanium alloys based on combinations of high cutting speeds with preliminary cooling of the machined surface. processing (WCO) rightfully occupies a leading place in the field of increasing the productivity of technological systems. Along with increasing productivity, the use of VCO will significantly improve the surface quality. Roughness values after VCO are commensurate with the roughness after grinding. The total duration of shaping has been significantly reduced. Cutting speeds with VCO are 7-12 times higher than cutting speeds with traditional machining. VSO provides opportunities for efficient processing of non-rigid and thin-walled parts [2].

The combined method of high-speed turning with additional cooling determines the mutual compensation of the disadvantages of one method with another, in particular, the compensation of high temperatures in the cutting zone in relation to the processing of titanium alloys. With additional cooling, liquid nitrogen is used as a lubricating cooling technological medium (COTS) in the cutting zone under pressure, the use of which significantly reduces the thermal stress of the process and increases the wear resistance of the cutting tool.

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