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STUDY OF THE INFLUENCE OF CUTTING CONDITIONS ON CUTTING FORCES WHEN DRILLING ALUMINUM ALLOY

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Abstract: *The article describes the features of the processing of aluminum alloys, in particular, cutting, considers the process of this type of processing of aluminum alloys, and the influence of its cutting conditions on the quality of surfaces*

Key words: *aluminum, aluminum alloy, cutting, cutting conditions, graph of cutting forces*

Aluminum alloys generally lend themselves well to machining. Unlike pure aluminum, aluminum alloys have a complex metallurgical structure. This is what gives them advantages in machining compared to unalloyed aluminium.

The various components that make up aluminum alloys have an important influence on the characteristics that make them relevant to machining. Non-abrasive alloy components have a positive effect, while insoluble abrasive components have a detrimental effect on tool life and surface finish. Components that are insoluble but soft and non-abrasive can be beneficial for machining as they promote chip breaking. Such components are specifically added, for example, to aluminum alloys for automatic cutting on high-speed machine tools.

In general, softer aluminum alloys and, to a lesser extent, some high-strength aluminum alloys are prone to metal build-up on the cutting edge of the tool. This buildup consists of aluminum particles that have melted and welded to the cutting edge of the tool.

To assess the influence of processing parameters on cutting forces, graphs of the dependence of cutting forces on the amount of tool feed (Figure 1) and cutting speed (Figure 2) were plotted. The graphs presented in Figure 1 confirm the linear dependence of the cutting forces on the drill feed.

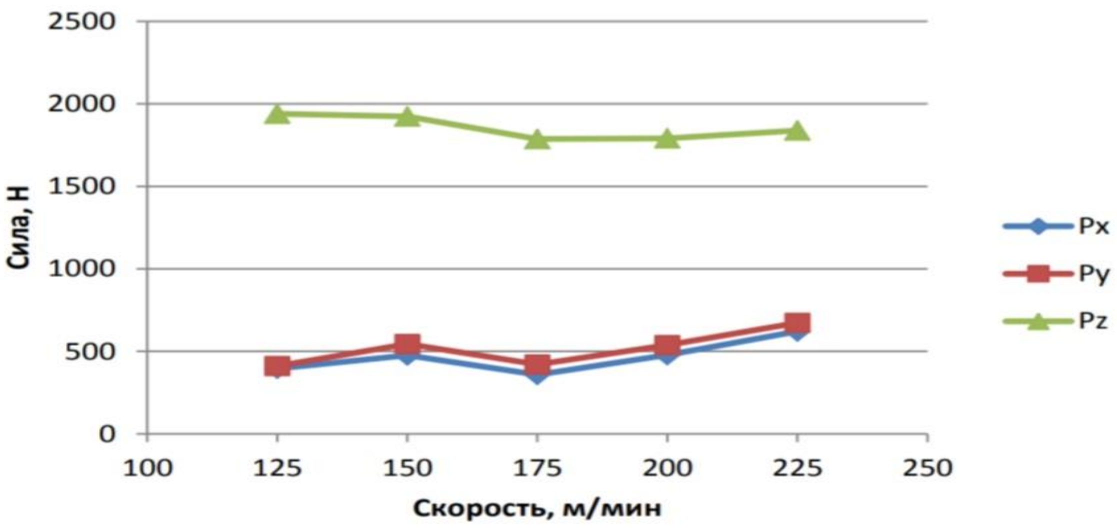

Figure 1 - Graph of the dependence of cutting forces on the feed of the tool

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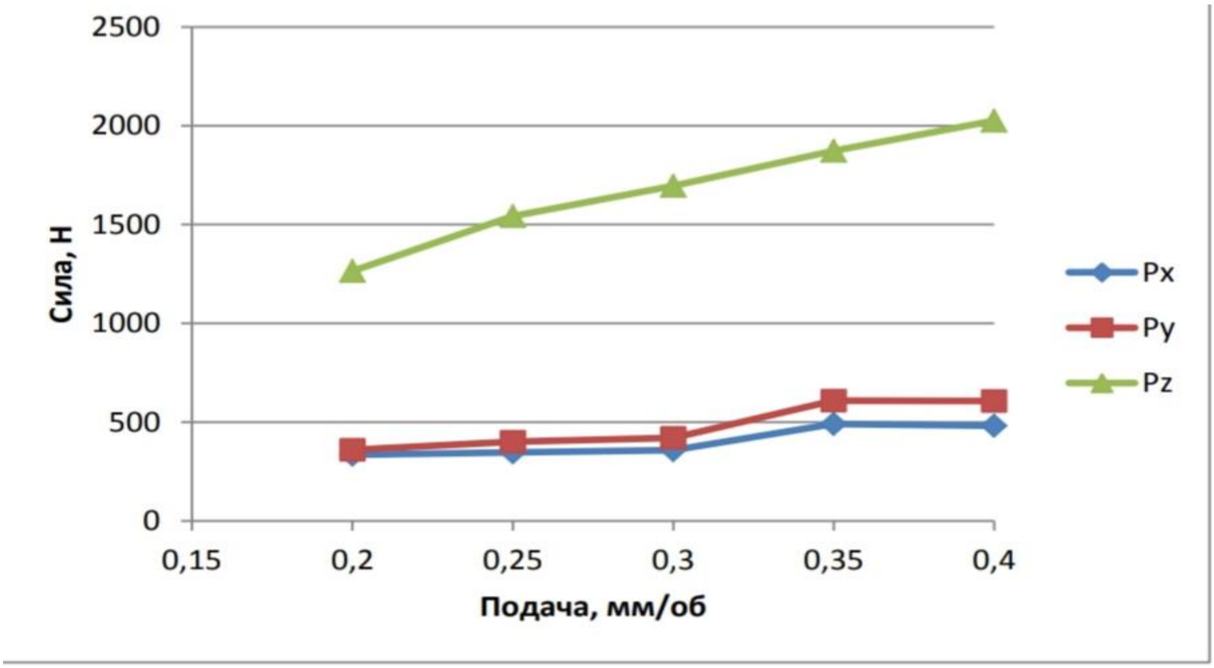

Figure 2 - Graph of the dependence of cutting forces on cutting speed

The presented graph in Figure 2 confirms that an increase in the tool feed entails a proportional increase in the cutting force directed along the Z axis of the drill. With regard to the cutting forces directed along the X and Y axes, the trend continues.

Unlike the linear dependence of cutting forces on tool feed, the dependence of cutting forces on cutting speed has a more complex form. So the absolute value of the cutting force directed along the Z axis decreases with increasing cutting speed up to a certain value and then begins to increase. As for the cutting forces directed along the X and Y axes, their dependence on the cutting speed is even more obvious. Making a general conclusion about the dependence of cutting forces during drilling on cutting speed, we can say that there is a cutting speed that is rational under certain technological conditions. Comparing the graph with the vibration resistance diagram, it is obvious that when drilling holes at a cutting speed that falls into the vibration resistance area, the cutting forces are minimal. When drilling holes at cutting speeds that fall into the zones of dynamic instability, the cutting forces are maximum. Drilling holes at cutting speeds that are on the boundaries of vibration stability is not obvious.

Thus, according to the dependencies shown in Figure 2, the processing of holes at a cutting speed of v-175 m/min is the most preferable in terms of the occurrence of deformation cutting forces.

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