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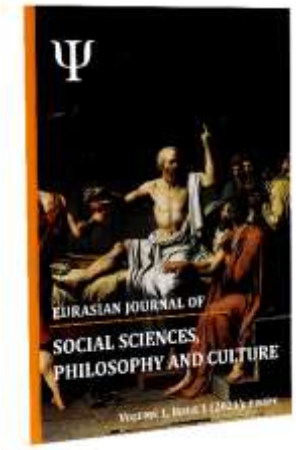

DESIGN OF DIES WITH SPLIT DIES

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ABSTRACT

The article discusses the process of radial extrusion using various lubricants and a Tab-based film coating. The grease that has the most optimal lubricating characteristics has been determined. The effect of the application of a Tab-based film coating on the surface of an actuating tool on the power mode of the process and the quality of stamped parts has been investigated. Recommendations for the use of this film coating are given.

Improving the quality of products based on the use and development of high-performance resource and energy-saving technologies is the main approach in solving the problem of ensuring the competitiveness of Ukrainian products in the world market. Bringing the level of our own production to the level of world standards is possible only with the use of resource-saving technological processes and, in particular, extrusion in dies with split dies [1-4].

At present, cold die forging is widely used in industry to produce a large number of parts. This method is used both for obtaining parts of a simple configuration that do not bear much responsibility, and for parts with a complex profile. In this case, the cold stamping method encounters such difficulties as filling the matrix cavity, because the metal quickly hardens, which greatly complicates its flow. For guaranteed filling, one resorts to increasing the deformation force in an already loaded process. This becomes the main reason for the failure of the die tool.

An example for solving the existing problem was the use in metal cutting of a tool with a wear-resistant film coating applied to the working surface [8]. In this case, a significant increase in tool wear resistance is achieved by reducing friction, that is, abrasion of the working surface [6,7].

The use of a tool with a sprayed wear-resistant coating can also improve the conditions of contact-plastic friction during the stamping process. To study the nature of the effect of the film coating on the friction during stamping and the general power regime, it was studied experimentally.

The preparation and deposition technique is described in [8].

A diagram of the setup for determining the parameters of contact plastic friction is shown in Fig. 15]. The film coating is sprayed onto the working surface of the mandrel 7. The registration of the force during the extrusion of the part 10 is carried out with a dose of 8.

To study contact plastic friction, studies were carried out on AD1 work pieces.

In the course of the experiments, the parameters of contact plastic friction were measured. The degrees of deformation were also calculated, corresponding to the stage-by-stage fixed parameters of friction.

The first series of experiments was carried out without the use of lubricants. In this case, in one case, the extrusion process was performed with a tool without applying a film coating to its surface, and in the second case, a tool with a sprayed TaB film participated in the experiment. The experimental dependences of the average coefficient of friction on the degree of deformation of the work piece are shown in Fig. 2.

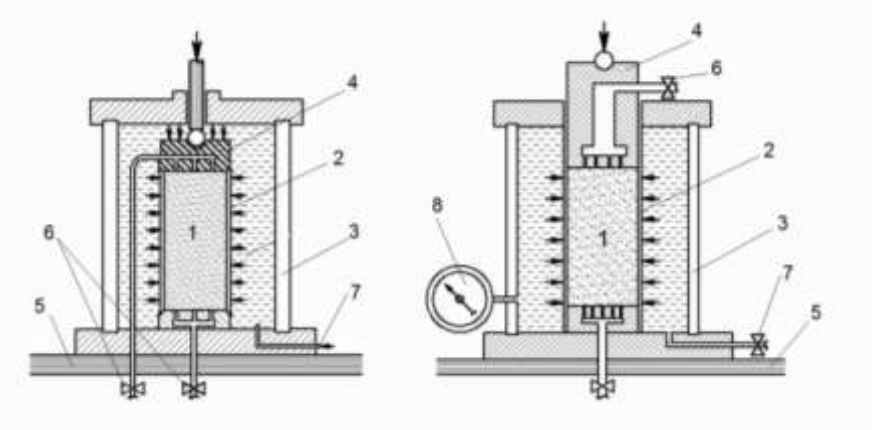

Fig. 1 - Experimental die for the study of contact friction

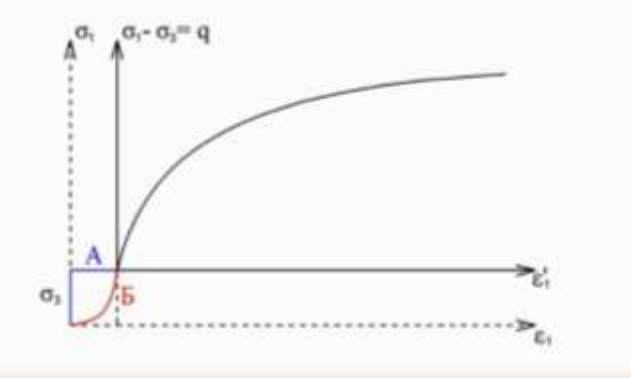

Fig. 2 - Dependence of the specific friction force on the degree of deformation for the process without lubrication.

When analyzing the dependences obtained, it was found that the use of a film coating in the process of stamping without lubrication led to a decrease in the average coefficient of friction by 70%.

The second series of experiments was carried out according to the same scheme, but with the use of lubricants. That is, at first, measurements were taken during stamping with ukrinol and KII 2 lubricants, and a tool without spraying. Then, the same process was repeated for the tool with the Tab film coated on the working surface.

The obtained experimental data were used to plot the dependences shown in Fig. 3 and fig. 4.

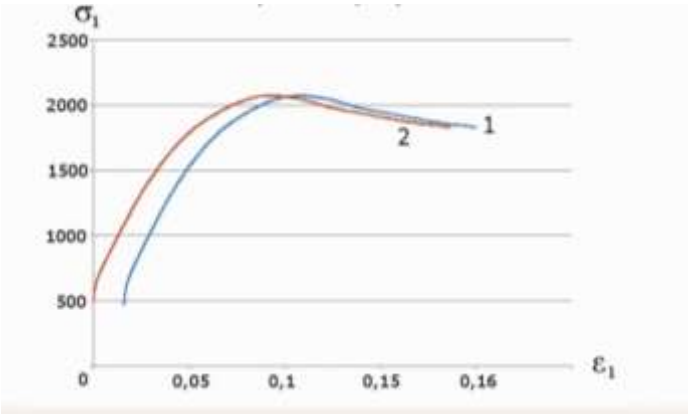

Fig. 3 - Dependence of the specific friction force on the degree of deformation for the process with the use of lubricants.

After analyzing the data obtained, we conclude that the use of a Tab film coating in the process of stamping with ukrinol lubricant led to a decrease in the average coefficient of friction by almost 50%, and with KII 2 lubricant by 20%.

Also in fig. 5 shows the dependences of the specific friction force on the degree of deformation for the experiment carried out using the MoS2 lubricant.

From the above graph, it can be seen that in the process using MoS2 lubricant, the application of the Tab film coating resulted in a decrease in the specific friction force by 17%.

It was found that the use of a tool with a film coating in the process of extrusion, on average, reduces the specific friction force in the range from 17% to 50%, and in the case of the process without the use of lubricants, the reduction in the specific friction force reached 70%. It is also possible to note a significant improvement in the surface quality of the resulting parts due to the filling and leveling of surface defects of the stamping tool.

CONCLUSIONS

It is recommended to use Tab based film coatings for radial extrusion processes and apply them to the working surface of the tool at the points of contact between the metal being processed and the tool.

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