AMERICAN Journal of Engineering, Mechanics and Architecture
Volume 2, Issue 6, 2024 ISSN (E): 2993-2637

Analysis of the Research Method for Extrusion of Hollow Products

Axmadaliyev Shoxrux Shuxratovich
Tashkent State Technical University, Tashkent., University Street, 2

Abstract: This article discusses the process of stamping by extrusion of hollow metal products. Formulas for the production of hollow products from hard-to-form metals are determined. The article shows the schemes of stress states and the main technological parameters during reverse extrusion.

Keywords: extrusion, stamping, tense state.

Recently, saving metal and the accuracy of geometric parameters in the production of certain products have become urgent problems in the field of mechanical engineering. Metal forming has been dealing with precisely such problems for several decades. By extrusion stamping, you can produce a variety of parts of complex configurations, and at the same time consume relatively less metal, unlike other types of metal processing processes. Before starting to produce products by extrusion stamping, research methods are carried out.

The main task of most theoretical solutions was to determine the stress state of the workpiece in order to calculate the specific deforming force depending on the compression, contact friction and tool shape. Extrusion stamping can produce both solid and hollow products.

The stress state and the main technological parameters are determined for the method proposed by the author for extrusion with distribution of a workpiece in a moving matrix, both for the case of extrusion from a conical matrix (Fig. 1, left) and for the case of extrusion from a cylindrical matrix (Fig. 1, right). It has been shown that extrusion with expansion can reduce the deforming force by 20% or more compared to extrusion in a cylindrical matrix, which, accordingly, increases the durability of the stamping tool several times and significantly expands the scope of extrusion.

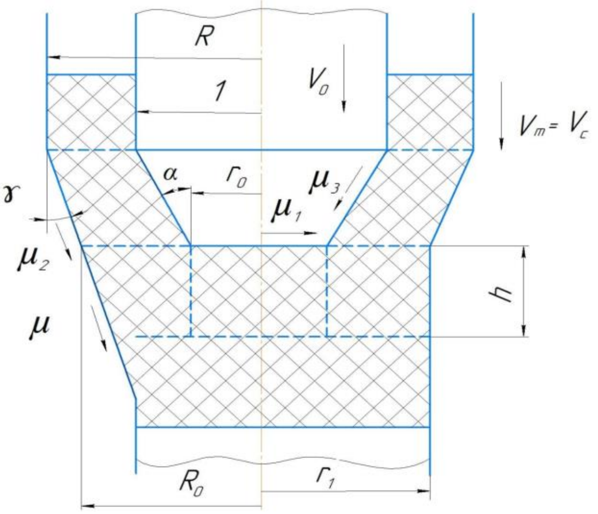

Figure 1. Stress state and main technological parameters determined

The kinematic and stress states were determined during direct extrusion of rod products from hard-to-deform materials in plastic shells (Fig. 2 on the left) [1]. A formula has been obtained to determine the optimal ratio of the yield stresses of the core and shell, ensuring the high-quality flow of the extrusion process

$$\frac{\delta_5^c}{\delta_5^o} = \frac{1 + \left(\frac{\mu sin\alpha + \mu_1 sin\gamma}{cos\gamma + cos\alpha} + \frac{\mu_1 c}{1 - cos\gamma}\right) ln\frac{R}{r}}{1 + 2ln\frac{R}{r}}$$

$sin\gamma = \frac{R_1}{R} sin\alpha \; cos\gamma = \sqrt{1 - sin^2\gamma}$

The kinematic and stress states of the workpiece during the reduction of hollow products on a mandrel were studied (Fig. 2 on the right). The initial kinematic analysis was carried out using a toroidal coordinate system. The analysis of the stress state took into account the elastic deformations of the mandrel and matrix, which made it possible to increase the accuracy of determining the reduction force, the inaccurate overestimation of which leads to unreasonable restrictions on the possibility of using this process. The resulting calculation ratios have an expanded scope of application, since they take into account the possibility of using active friction forces during reduction by forced movement of the mandrel in the direction of reduction.

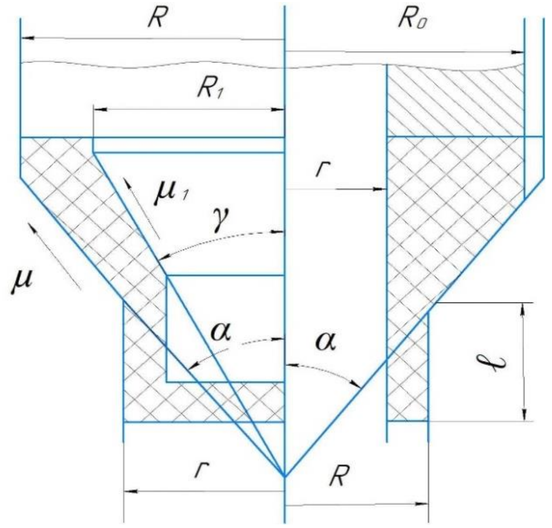

Figure 2. Kinematic and stress states of the workpiece when reducing hollow products on a mandrel

The theoretical results were compared with the experimental data of other researchers, which confirmed their high convergence (the maximum discrepancy did not exceed 2.9%).

Conclusions

During radial extrusion, four zones are formed with different deformed states and a corresponding uneven distribution of mechanical properties, which must be taken into account depending on the specific purpose of the resulting product [2].

An increase in the thickness of the extruded transverse protrusion increases the likelihood of crack formation on the side surface of the protrusion, and a decrease in this thickness increases the likelihood of cracking at the transition point of the protrusion into the core part of the product.

REFERENCES:

1. Abdullaev F.S. Khasanov K.A. “Theoretical analysis of the radial extrusion operation and the scheme of the used stamp” at the International Scientific and Technical Conference “Problems and Prospects of Innovative Engineering and Technologies in the Agricultural and Food Sector” April 24-25, 2020

2. Axmadaliyev Sh.Sh. Development and research of technological processes of combined compression stamping of axisymmetric details: Ph.D. (PhD) diss. autoref. / Axmadaliev Shoxrux Shuxratovich - Tashkent, 2012. - 50 p.