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Particularities on Hydrostatic Extrusion Technological Variants

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Abstract

Beginning with the analysis of the difficulties of applying hydrostatic extrusion process in industrial production, the paper proposes to present some of the most known variants of the process, the way in which these methods success to avoid some unfavorable factors that have an influence on the product quality as well as have an influence on the stability of the process.

***Keywords**: extrusion, hydrostatic, pressure.*

1. Theoretical aspects

The application difficulties of hydrostatic extrusion for certain concrete situations have resulted in the diversification of the process utilization solutions. Such are to be differentiated mainly depending on the way in which the interaction occurs among the elements: used outfit - hydraulic agent– half-finished product (slab billet) . Except for the classical extrusion chart also known as simple hydro pressing another four charts, figure 1, are deemed as representative while others could be a consequence of their different combinations.

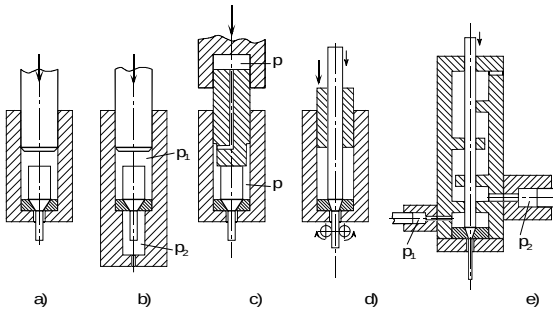

Fig. 1. a – simple hydro pressing; b – hydrostatic extrusion with backpressure; c – hydromechanics or magnified pressing ; d – semi continuous hydrostatic pressing; e – continuous hydrostatic pressing.

Simple hydrostatic pressing (classical), figure 1a, displays a series of inconveniences, at first related to the absence of the process control, in direct connection to its unstable character. For instance, after priming, the pressure inside the extrusion precinct becomes unsteady , as a result of the extrusion speed fluctuation , which in its turn is caused by such factors as: variation in the magnitude of friction force of the half-finished to the stencil walls within the active area, the material anisotropy , the elasticity of the technical system , etc. Consequently, quality flaws of the extruded parts are likely to occur and become manifest by their roughness deterioration and buckling. Another reason of quality parameters loss or even damage is the aggressively fast release of the finished product.

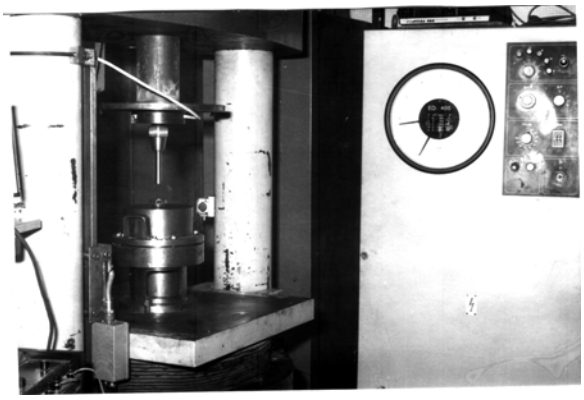

Fig. 2

At the University "Dunarea de Jos" of Galatzi, at the Plastic Cold Forming Lab, within Mechanical Engineering Technology (T.C.M.) Department, on using a proper stencil, fitted out on a 10 KN hydraulic press, hydrostatic extrusions have been performed in keeping with the classical model. Aluminum and copper half-finished (billets) have been used and the technical system is that one indicated by figure 2. The experimental attempts aimed the check-up of previously expressed statements with reference to

simple hydro pressing limits, and if they are biased by technological factors such as the deformation degree. The extrusions achieved with different deformation degrees resulted in parts of the type shown by figure 3, some of them with shape errors and surface deficiencies. Phenomena are amplified in case the process is not interrupted before the complete extrusion of the billet, when there occurs the aggressive release of the parts from the precinct of the extrusion stencil , as a result of the high pressures existing within the precinct, as they could reach 20 Kbar during the process unfolding.

Fig. 3

The consequences thereof are serious faults with extruded parts as one can find out of figures 4, 5 and 6.

Fig. 4

Fig. 5

Hydrostatic extrusion with backpressure, figure 1b, considerably decreases the percentage of parts showing surface faults, due to the improvement of friction conditions between the billet and stencil surfaces. The release speed is also reduced. The technological outfit is but more complexes as it requires an additional system for the constant maintenance of hydraulic agent pressure within the emergence area. The system for taking over the parts after extrusion also becomes more complicated.

With *hydro mechanical pressing* the hydrostatic extrusion process is much more improved by applying an additional mechanical force directly to the billet.

There are several ways in which the mechanical force can be applied to the billet. One of the most frequently used methods, figure 1c, is the mode in which the mechanical strain is applied onto the billet upper face by means of a specially designed piston.

Fig. 6

To prevent pressure increase around the billet, during the piston drift inside the stencil chamber, thereto a channels assembly is achieved to allow hydraulic agent passing from the amplifier onto the upper side of the outfit, over to the high pressure precinct. This way a constant stress is carried out on the billet surface during the extrusion and thus the lateral distortion is being avoided , figure 7.

Fig. 7

Previously introduced hydrostatic extrusion variants are only workable in such cases when the billet is completely plunged into the high pressure liquid and, despite the possibility of using oversize billets, yet their length is always limited by the container dimension. The need for billets replacement at certain periods , turns this type of extrusion into a discontinuous process and therefore less appealing from the economical point of view when compared to another continuous processes. To eliminate given default as well as to increase efficiency, researches have been carried out to get a certain feasibility of the hydrostatic extrusion process in case a billet of undefined length is continuously supplied to one end of the high pressure container and continuously extruded to the other end thereof.

With *semi continuous hydrostatic extrusion*, figure 1d , the process progress depends on the accuracy of the billet / extruded part drive, meaning to provide a critical value of the axial force. The billet is driven by pushing on using certain delivery gears, which are discontinuously acting by grabbing. Such can be placed inside the high pressure chamber or may consist of a composite system, made of a mechanism designed to push it into the admission area (in compound with the sealing system) and another mechanism, designed to draw the part , and operating at its escape from the stencil, after extrusion. As the material quantity of the extruded part released from the stencil, equals that of the billet entered into the stencil, the two mechanisms have different strokes which have to be synchronized and correlated depending on each given situation.

The main issue, being settled with *continuous hydrostatic extrusion,* figure 1c, is the way of achieving the axial stress required for the billet drive with a view to extrusion. That was possible by using

the so-called viscous friction. The highly viscous hydraulic agent, through the extremity of the high pressure precinct, enters the supplying area and is under control eliminated in the vicinity of the active area, no passing through a number of ring-shaped gaps, formed between the billet surface and the precinct restrictive crests. In those areas, caused by the diminished flow profile (section), the friction force between the billet surface and the viscous liquid displays considerable values. That way, the billet drive is being carried out as for extrusion.

Conclusions

The above mentioned have clearly demonstrated that the irrefutable advantages of hydrostatic extrusion, mainly those regarding the manufacturing of extremely short section products, out of frail or hardly deformable materials, of indefinite lengths , induced the field research to bring about the preclusion of the difficulties and identification of certain solutions meant to allow the settlement of technical issues. It's therefore obvious that given processing type appears as and will continue to stand for a substitute in solving specific technical problems, wherever conventional methods are somehow limited or unlikely to be applied. To that respect, there is undoubtedly enough reserve concerning the discovery of new hydrostatic extrusion methods to differ from those introduced by the present paper.

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Particularități privind variantele tehnologice ale extrudării hidrostatice

Rezumat

Cunoscute fiind dificultățile de aplicare a extrudării hidrostatice în producția industrială lucrarea îşi propune să prezinte câteva dintre variantele de succes ale acestui procedeu, modul prin care acestea pot să înlăture anumiți factori perturbatori care au o influență negativă asupra calității pieselor extrudate şi stabilității procesului de extrudare

Les Particularités Regardant Les Variantes Technologiques Des Processus D´Extrusion Hydrostatique

Résumé

L'article propose a présenter des meilleurs variantes des processus commencent avec l'analyse des difficultés entendus dans les processus industrielles de l'extrusion hydrostatique. Il y est présenté l'applicabilité de ces méthodes pour éviter les facteurs avec l'influence négative sur la qualité du produit et aussi sur la stabilité des processus.