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ASPECTS OF THE ROUGHNESS PARTS OF NON-FERROUS METALS OBTAINED BY EXTRUSION DIRECTLY TO COLD

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Abstract: *In the first part of the work are presented some sorts of parts in aluminium, lead and copper, obtained by direct, extrusion. In the second part of the work is presented by means of tables and diagrams the roughness of the surfaces of the parts in aluminium, lead and copper, obtained by direct extrusion with more sorts of active plates,with and without lubrication. It is also presented the roughness of the parts in aluminium in comparison with those in lead and copper.*
Key words *: roughness, direct extrusion, aluminium, lead, copper, non-ferrous metals.*

1. INTRODUCTORY CHAPTER

In the present the cold extrusion is used in a great range of non-ferrous alloys, machine building, armament a.s.o. Aluminium and aluminium alloys represent the most important part of these alloys in the cold plastic deformation by means of extrusion (([1], [2], [3]).

Owing to the fact that for many times the quality of the surface has influence upon the functional part of the parts, it is necessary to analyze the roughness of surfaces of the parts in non-metallic materials at cold extrusion.

In order to make the analysis of the roughness of the surfaces in aluminium there were made parts of cylindrical and half-cylindrical aluminium raw material.

The mineral oil has been used for lubrication.

At the direct extrusion the degree of deformation was different ε=83.34% (D_0=24,5mm and D_f=10mm) and ε=62,51% (D_0=24,5mm and D_f=15mm). The active plates which have been used have different half angle α: convex active plate (α=120˚; 105˚); plane active plate (α=90˚ and the rounding radius r=0; 2; 4 mm); conic active plate (α=60˚; 45˚).

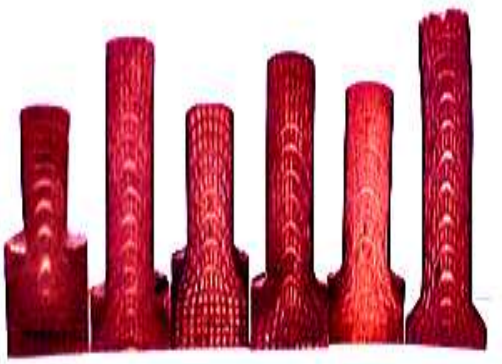
The parts obtained by direct extrusion could be seen in Fig. 1, 2 and 3.

a b c

Fig. 1. Parts in aluminium directly extruded with active plates: a-convex; b-plane; c-conic; ε=62,51%.

a b c

Fig. 2. Parts in lead directly extruded with active plates: a-convex; b-plane; c-conic; ε=83.34%.



a **b** **c**

Fig. 3. Parts in copper directly extruded with active plates: a-convex; b-plane; c-conic.

2. ROUGHNESS OF PARTS IN NON-FERROUS METALS OBTAINED BY DIRECT COLD EXTRUSION

After their cleaning the extruded parts have been measured by means of roughness tester, Fig. 4, and all data have been stated in the table below. There were drawn the diagrams using the SigmaPlot 2001 program.

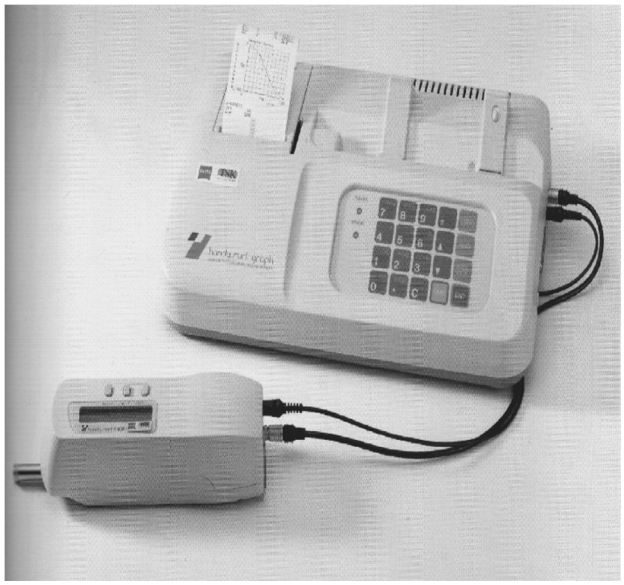


Fig. 4. Roughness tester.

In Table 1 and Fig. 5 one can see that at the parts obtained by direct extrusion the roughness decreases at the same time with the increase of the degree of deformation. It is also more decreased when using the plane active plates without radius of connection in the area of deformation.

Table 1

R_a ED roughness [μm].

Angle of the active plate active [°]	Degree of deformation	
	ε_1=62,51	ε_2=83,34
120	0.1600	0.1600
105	0.3600	0.4600
90r0	0.6000	0.7000
90r2	0.5600	0.6000
90r4	0.5000	0.5300
60	0.4300	0.5300
45	0.3300	0.3600

As one can see in Table 2 and Fig. 6 a better roughness at the parts obtained by inverse extrusion could be obtained on the internal surfaces in comparison with the external ones.

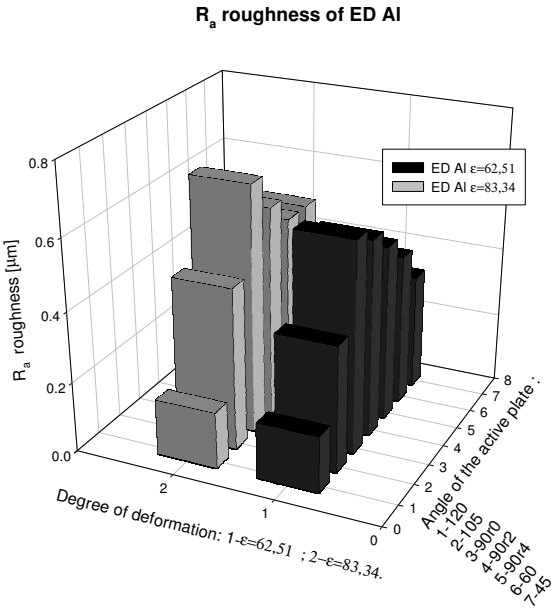


Fig. 5. R_a roughness of the surfaces of the parts in aluminium by direct extrusion.

Lubrication reduces the friction between the active elements and mould and total deformation force too. There are otter aspects influenced by lubrication such us : stress (is reduced) wear of tools (decrease) and surface quality (increase).

Analyzing the values of roughness in Table 3 and Fig. 6 it could be observed that in case of using the mineral oil as lubricant the roughness got for the parts in aluminium is much better than that in case of extrusion without oiling.

Table 2

Roughness R_a parts in aluminium directly extruded with and without lubrication [μm].

Angle of the active plate [˚]	Parts in aluminium directly extruded	
	with lubrication	without lubrication
120	0.1600	0.4300
105	0.4600	0.6500
90r0	0.7000	0.9100
90r2	0.6000	0.8000
90r4	0.5300	0.7000
60	0.5300	0.6200
45	0.3600	0.5500

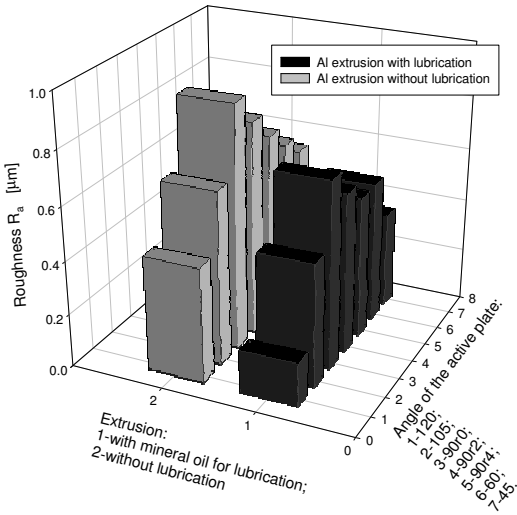


Fig. 6. R_a roughness of the surfaces of parts in aluminium direct extrusion with and without lubrication.

Table 3

Roughness R_a parts in lead directly extruded [μm].

Angle of the active plate active [˚]	Degree of deformation	
	ε_1=62,51	ε_2=83,34
120	0.2000	0.2500
105	0.2000	0.3000
90r0	0.4000	0.4500
90r2	0.5000	0.6000
90r4	0.4000	0.4000
60	0.3000	0.3000
45	0.2000	0.2500

Analyzing the roughness at the testing parts of non-ferrous metals got by direct extrusion, Table 3 and Fig. 7, one could observe that the better roughness has resulted when extruding the copper and the less good one when extruding the aluminum. It could also observe that the weakest roughness has resulted when using the plane active plates with no connection radius in the deformation area.

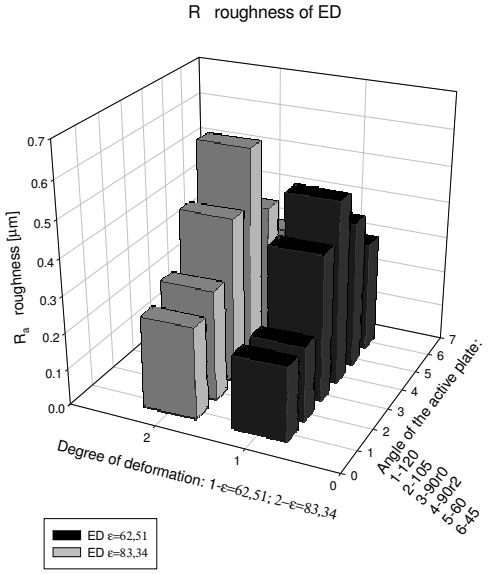


Fig. 7. The R_a. roughness of the surfaces of the parts in lead by direct extrusion.

In Table 4 and Fig. 8 one can see that the roughness of the parts in aluminium obtained by direct extrusion is bigger than that of the parts in copper or lead.

Table 4

Roughness R_a parts of non-ferrous metals directly extruded [μm].

Angle of the active plate [˚]	Material		
	Copper	Lead	Al
120	0.1600	0.2000	0.1600
105	0.1600	0.2000	0.4600
90r0	0.2000	0.5000	0.7000
90r2	0.1600	0.4000	0.5300
60	0.2000	0.3600	0.5300
45	0.2000	0.3000	0.3600

3. CONCLUSIONS

As concerns the roughness of the surfaces of the parts in aluminium by cold extrusion the

following conclusions could be drawn: at the parts by direct extrusion the roughness decreases at the same time with the increase of the degree of deformation and also it is lower when using the plane active plates.

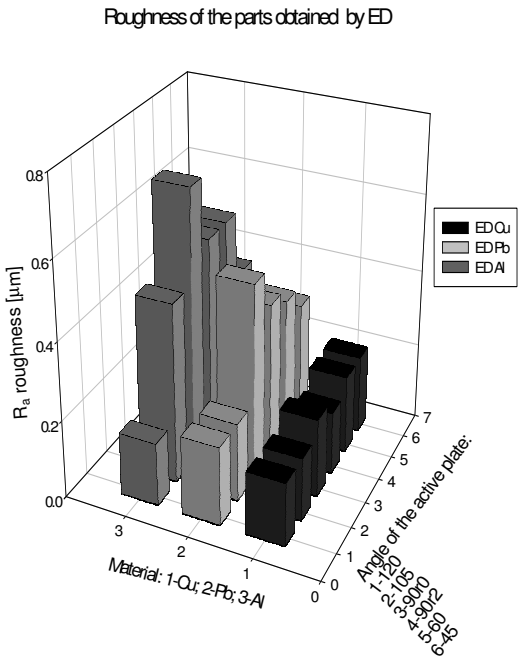


Fig. 8. R_a roughness of the surfaces of parts of non-ferrous metals by direct extrusion.

As regards the roughness of the surfaces of the parts in aluminium extruded by cold extrusion the following conclusions could be mentioned:

- at the parts directly extruded the roughness increases with increase of the deforming degree and also it is more accentuated when the plane active plates are used;
- at the parts of non-ferrous metals got by direct extrusion, the better roughness has resulted when extruding the copper and the less good one when extruding the aluminium. At the same time the weakest roughness results when using the plane active plates with no connection radius in the deformation area;
- when the mineral oil is used as lubricant aluminum parts roughness has lower values than the case of extrusion without oiling;
- the accuracy of the geometric form of the products of metals and non-ferrous alloys, that have low hardness, got by extrusion, is influenced very much by the accuracy and active elements quality;
- the roughness of the parts in aluminium obtained by direct extrusion is bigger than that of parts in copper or of those in lead.

4. REFERENCES

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Aspecte privind extrudarea pieselor de metale neferoase obținute prin extrudare directă la rece

Abstract: În prima parte a lucrării sunt prezentate câteva tipuri de piese din aluminiu, plumb și cupru obținute prin extrudare directă. În a doua parte a lucrării sunt prezentate prin tabele și diagrame rugozitatea suprafețelor pieselor din aluminiu, plumb și cupru, obținute prin extrudare directă cu mai multe tipuri de plăci active, cu și fără lubrifiere. Se prezintă, de asemenea, rugozitatea părților din aluminiu în comparație cu cele din plumb și cupru.

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