METHOD OF GRIDS APPLIED TO DIRECT EXTRUSION TECHNOLOGICAL OPERATION

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Key words: extrusion, grid, deformation, tilt angle

Abstract: The method of grids (divided networks) shall be especially used for studying the deforming condition and stresses condition and it is based upon the theory of finite deformations. On the thickness of the semiproduct material has been drawn a network of parallel and perpendicular lines measuring among them a distance of 1 mm.Four dies especially changed for testing have been used, having the following geometric size (tilt angle x height of deforming area): ”30^{o}x10mm”, ”15^{o}x20mm”, ”60^{o}x1mm”, ”15^{o}x7mm”.

1.Generalities

The method of grids (divided networks) shall be especially used for studying the condition of deformation and the condition of stresses and it is based upon the theory of finite deformations, according to which an elementary sphere figured in the material submitted to deformation shall be transformed into an elementary ellipsoid. The ellipsoid they got after deformation has the axes directed according to the directions of the main stresses.
The divided networks may be drawn on both the outside surface of the semiproduct (especially on thin sheets) and on a plane designed for dividing into sections of the semiproduct (on massive parts); in the last situation the surface designed for dividing into sections must remain a flat one in the course of deformation, so, on this surface the action of the normal stresses shall be forbiden. The used divided networks are : circumferential and radial, systems pf parallel and perpendicular lines drawn at equal distances among them, systems of tangent circles having the same diameter (of low value). The networks may be applied by making some ribs by recording by the aid of electrochemical methods or by using paints of photoactive emulsions.
When the network is applied on a plane designed for dividing into sections, the sample shall be divided into two halves. On the contact surface of one of these halves shall be made the network an don the contact surface of the other half shall be applied a lubrifiant which shall hinder the soldering of the parts of the sample during the work; after that the two halves shall be joined by some welding points. The so prepared sample shall be subdued to the deformation under the condition of actual testing or on an experimental model; after that the two parts shall come appart and the divided network shall be submitted to the analyses.
The network size shall be measured by using a lab microscope.

2. Drawing and Deforming the Grids

On the thickness of the semiproduct material has been drawn a network of parallel and perpendicular lines having among them a distance of 1 mm, both on vertical and horizontal planes, with the thickness of the line of approx. 0,1 mm.
These lines have been accomplished by the aid of special drawing needle on a coordinates milling machine.
The round shaped test pieces have been divided into sections in an axial manner. Four dies especially changed for testing have been used having the following geometric size (tilt angle x height of deformation area): 30^{o}x10mm, 15^{o}x20mm, 60^{o}x1mm, 15^{o}x7mm. Two testing pieces have been disposed in pair, one of them drawn with grid network, both being previously greased on the contact part and they have beel soldered by two welding points on the ends.

The so formed testing pieces have been introduced in the die for carrying aut the experiment. After the extruding operation the two testing pieces have been separated and the deformed grids are shown in the figures 1-4.

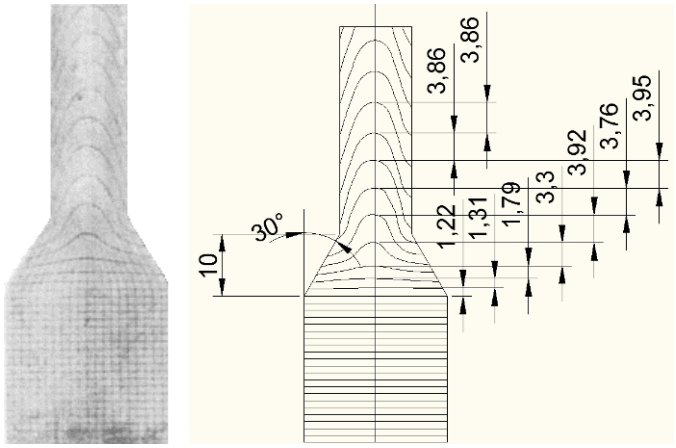

Fig.1 Die grid network 30°x10mm

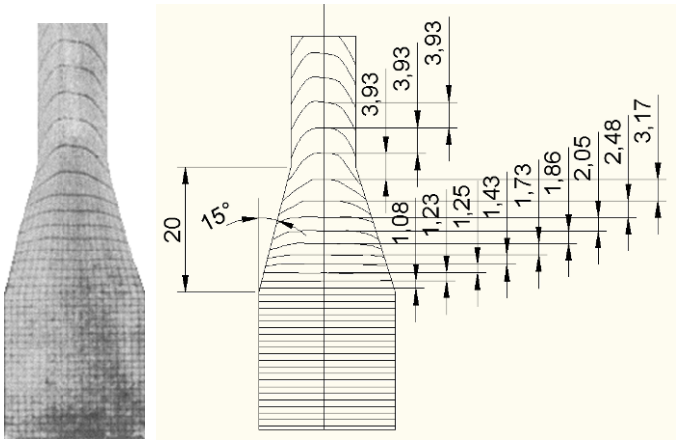

Fig.2 Die grid network 15°x20mm

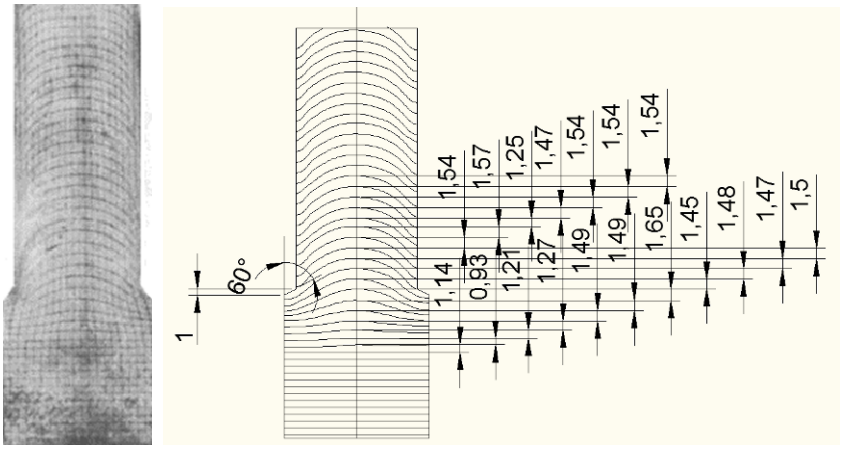

Fig.3 Die grid network 60° x 1mm

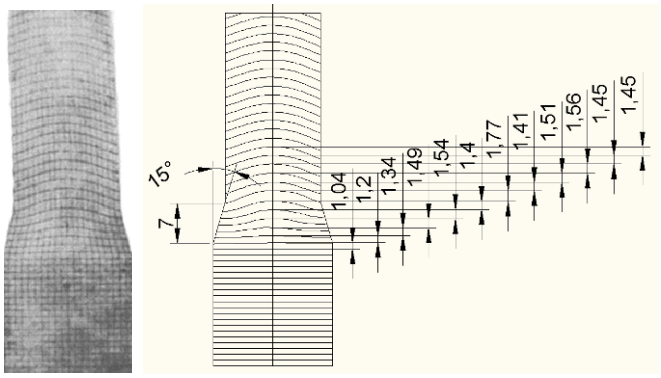

Fig.4 Die grid network 15°x7mm.

3. Statistic Processing of Data

In the table 1 are shown the values of the size of the networks after the accomplished plastic deformation and the their graphic retort is shown in the figures 5-9.

Table 1 Values of size of deformed networks

No. of fiber	30°x10mm	15°x20mm	60°x1mm	15°x7mm
-9	-	-	1,14	-
-8	-	-	0,93	-
-7	-	-	1,21	-
-6	-	-	1,27	-
-5	-	-	1,49	-
-4	-	-	1,49	-
-3	-	-	1,65	-
-2	-	-	1,45	-
-1	-	-	1,48	1,04
0	1,22	1,08	1,47	1,20
1	1,31	1,23	1,50	1,34
2	1,79	1,25	1,54	1,49
3	3,30	1,43	1,25	1,54
4	3,92	1,73	1,47	1,40
5	3,76	1,86	1,54	1,77
6	3,95	2,05	1,54	1,41
7	3,86	2,48	1,54	1,51
8	3,86	3,17	1,54	1,56
9	3,86	3,93	1,54	1,45
10	3,86	3,93	1,54	1,45

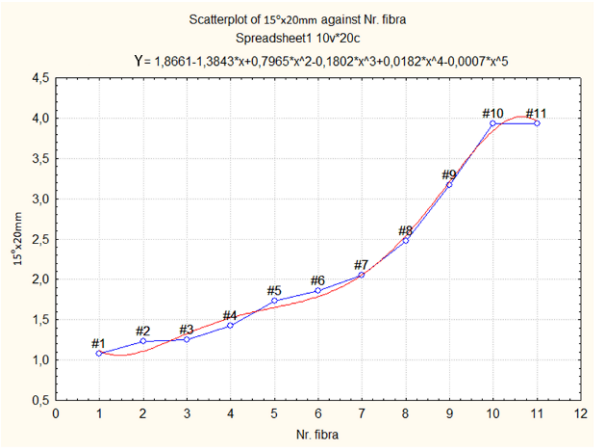

Fig.5 Variation of network size of material extruded with die 30°x10mm

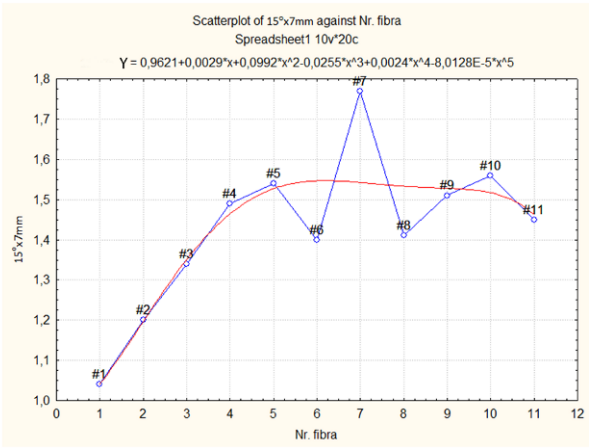

Fig.6 Variation of network size of material extruded with die 15°x7mm

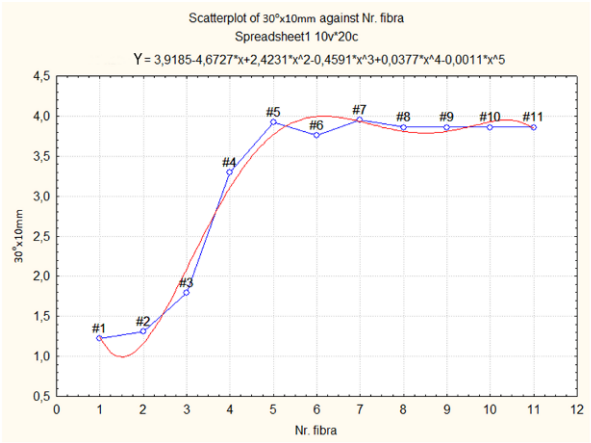

Fig.7 Variation of network size of material extruded with die 30°x10mm

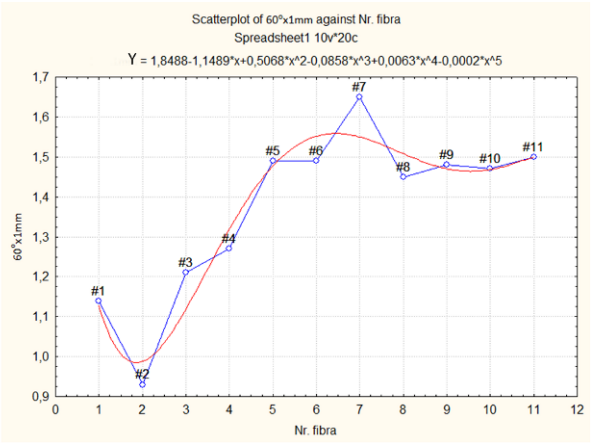

Fig.8 Variation of network size of material extruded with die 15°x7mm

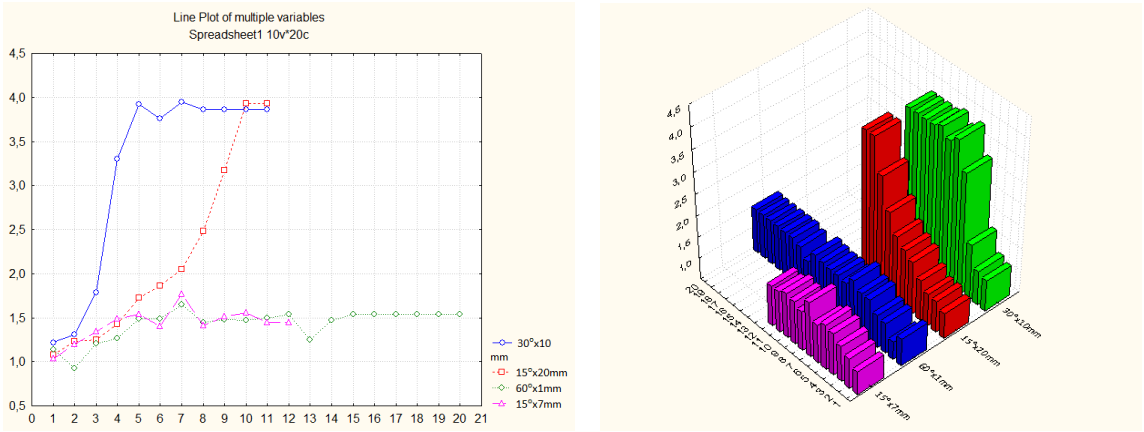

Fig.9 Comparative diagrams on the variation of the grid size

4. Conclusions

The size of the deformed network is superior according to the die 15°x7mm, butthe augmentation of the size of the deformed network with the die 30°x10mm is faster.

According to the diagrams shown above it may be noticed that at the same tilting of the die (15°) the deformation of the material shall be less if the deformation area is less, too. This may be explained thank to the fact that the degree of deformation is higher for the last situation, getting this way a less diameter of the accomplished part.

If in the case of extruding the variants ”30°x10mm”, ”15°x20mm” the deformation of the grid starts even from the entrance into the deformation area, on the variant ”15°x7mm” the deformation shall start with fiber forward and on the variant ”60°x1mm” the deformation shall start with 9 previous fibers.

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