Influence of the coefficient of shape of welding over strength of internal structural junctions of geocells

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Abstract. *Geocells are innovation products with wide application in practice. Engineering usage of them depends mainly on their mechanical properties .In this article will be analyzed the influence of the coefficient of shape of welding over internal structural junctions of geocells according EN ISO 13426-1:2019,method B.*

1 Introduction

Geocells are structure of welded strips from HDPE(Fig.1). As compared to the planar form, the three-dimensional 'Geocell' is comparatively new invention in soil-reinforcement [1].They take place of many infrastructure projects like construction of highways,rail roads,constructions of erosion control,construction of cannels and fundaments. Their popularity, product range and applications continue growing due to the associated significant technical, economical and environmental advantages[1].

Fig.1 *Geocells*

2 Characteristics and application of geocells

Engineering characteristics may be separated to following groups-geometrical like welding distance,length of strips,cover area,type of perforation thickness of strips etc,physicochemical like density,coefficient of friction,oxidation time,UV stability and mechanical-tensile strength of strip and tensile strength of welding.The standardized applications are reinforcement, drainage,arming, separation. [3].Wide application of geocells define individual approach according function,application,loading,desired cover area and many others factors.Analyze of specifications of some world producers shows that the main quality sign that distinguish the products is the average thickness of strips.The most common average thicknesses are 1.3 mm and 1.45 mm.Geocells are manufactured using ultrasonic welding technologyThe width of welding is constant,because it depends only on tool of welding(horn).The most common width of welding is 10mm.The Penetration depth is the amount of the both thicknesses of strips,therefore the shape of welding vary only when the average thickness of strips is changed. (fig) 2. [4].

The most common published by producers mechanical properties are

- Tensile strength of strips according ISO 10 319.
- Tensile strength of internal structural junctions according EN ISO 13 4261:2019.

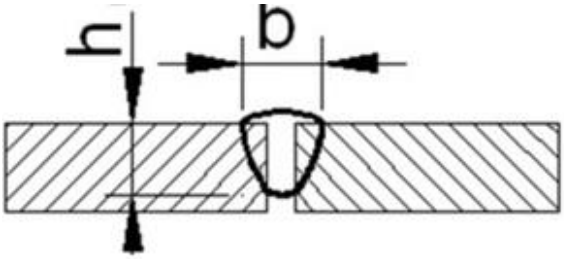


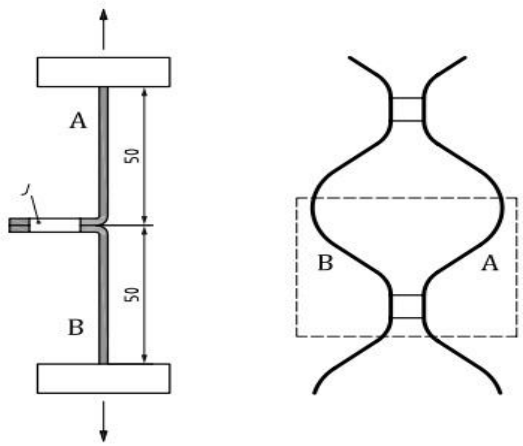
Fig 2. *Geometrical characteristics of welding,b-width of welding,h-penetration depth of welding*

3.Testing

The testing are performed on calibrated universal two columns tensile testing machine KQL-5kN(fig.3).The jaws of the testing machine are suitable for polymers,the width of jaws is compliant to the width of samples,the height of the machine is suitable to elongation of samples,the inside surfaces of jaws are knurled for better contacting.All testing requirements of the standard are met.

Fig..3 *KQL-5 kN.*

The testing include 10 samples with average thicknesses 1.45 mm,1.3 mm and 1.15 mm from one batch.The chosen mechanical testing is strenght of internal structural junctons according EN ISO 13426-1:2020,method Б.The tested samples are from HDPE ,width 100mm,bilateral tolerance 3mm,tolerance of average thickness till 5% The location of sample and principle scheme is shown in fig 4.



Фиг 4.*Location of sample and principle scheme according БДС EN ISO 13426-1:2020,method. [5].*

For convenience only the maximum applied force will be recorded, the recorded dimension is kN, according the standard.

Average thickness-δ-1.45 mm

1.22	1.25	1.27	1.24	1.23
1.25	1.25	1.24	1.23	1.22

Avarage thickness-δ-1.3 m

1.21	1.19	1.2	1.24	1.21
1.23	1.24	1.18	1.17	1.2

Avarage thickness-δ-1.15 m

1.03	1.0	1.05	1.03	1.01
1.06	1.06	1.1	1.04	1.03

4. Statstic treatment of the recorded data

Maximum value	1.27 kN
Minimal value	1.22 kN
Dispersion	0.05 kN
Avarage value	1.24 kN

Avarage thickness-δ-1.45 mm

Maximum value	1.24 kN
Minimum value	1.17 kN
Dispersion	0.07 kN
Avarage valu	1.2 kN

Avarage thickness-δ-1.3 mm

Maximum value	1.1 kN
Minimum valu	1.0 kN
Dispersion	0.1 kN
Avarage value	1.04 kN

Avarage thickness-δ-1.15 mm

5.Analyze of the results

There is significant correlation between the average thickness and the average values of recorded maximal force. Avarage thicknesses 1.45/1.3 mm and recorded average maximal forces-correlation ratio- 92% avarage thicknesses 1.45/1.15 mm and the recorded avarage maximum forces-correlation ratio 94%.There is significant correlation above 90 %, between the average thicknesses.and recorded dispersion, maximum and minimum value.

6.Sensitivity of results

Tensile testing of thin polymers frequent leads to slippage of samples during testing and significant lower results. In such cases the testing should be repeated on objectivity reasons. Some of the reasons for slippage are

- Plasticity of the materials
- Increased clearances of mechanical elements of the testing machine (bolts, nuts, pins)
- Unsuitable putting of the sample, unparalleled to the jaws
- Outworn knurls of jaws
- High speed of testing, more than the defined in the standard(50m/min)
- Untighted jaws..

Sensitivity of testing often is parallel object of analyzes with classical tool like FMEA [6].

7 Conclusion

The average thicknesses of the tested samples and recoded maximal forces according EN ISO 13426-1:2020,method B,show signigicant correlation (above 90%) between them.The testing according this standard and relative to it standards should be monitored very carefully because of potential slippage of the sample.

References

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