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Relative True Deformation of Greenhouses Film Depending on The Orientation

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Abstract

Uniaxial tensile measurements on low-density polyethylene film samples have been realized by mean of a mechanical device. The optical measurement of ink lines drawn on the top surface of the film at respective distances between each other, has contributed in the understanding in the way of how the film deforms when subjected to a stress. The films are tested in three different directions (0°, 45° and 90°). The results showed that relative elongation and true strain are greater in the 45° stretch followed by 90° then 0°. Also, it has been found that the deformation in the right side is more pronounced. However, it should be noticed that the planes delimited by the marks remain uniform during the whole deformation meaning that the lines of ink remain parallel during the total duration of the experiment.

Keywords: Low Density Polyethylene Films; True Strain; Optical Measurement; Orientation

Introduction

Polyethylene films produced by the Algerian plastics industry are mainly used for greenhouses covering. They are subjected to many mechanical stresses, such as creep in reason of the greenhouse shape or to dynamic mechanical stresses such as those generated by the wind. The lifetime of these greenhouses is indeed dependent to the defects acquired during polymerization of the ethylene or during processing by blow extrusion [1,2]. It is more this last aspect that is in our interest since it is possible by mean of a mechanical device to see how the orientation acquired during processing can affect the response of the material subjected a mechanical solicitation. In fact, it is known that LDPE films has an anisotropic character due to the molecular chains orientation in the main processing directions [3,4]. The goal of this work is to check the orientation effect on the displacement plans of polyethylene film under controlled deformations by means of an extensometer realized in the laboratory and using a camera which follows the displacement of drawn lines for defined extension rates. The full study would largely exceed the introduction scope of our study. However, only the methodology and the results with relation of the orientation dependence are presented in this work.

Plans Deformation

The lateral contraction results for all the samples were obtained by using a mechanical device at room temperature. The apparatus is constituted by two clamps one is fixed and another movable. The moving part is monitored by concentric bars and the displacement of the mobile clamp is controlled by a screw. Both clamps are covered with rubber to help clamping and to prevent samples slippage during deformation. Rectangular samples of 110mm×10mm were used for tests, with a calibrated portion of length L0 = 80mm, W0 = 10mm and thickness T0 = 0.16mm. They were cut directly from the LDPE films at one of tree angles, 0°, 45°, and 90° deformations, accordingly, corresponding to MD, TD/2, and TD respectively. Different marks are placed on the right and the

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left of the middle of the sample to follow the material deformation by optical measurements. "ri" is defined as the distance between the middle and marks situated on the right of the middle sample. The distance "li" is the distance between the middle and the marks situated on the left of the middle sample. At a selected distance, a fixed camera is placed above the montage to keep the same test conditions for all the tests.

The picture resolution is set at its maximum (7.2mega pixel); this allows a maximum magnification for further treatment and for the calculations of the elongation and the deformation. The pictures obtained are treated then using MATLAB. Hence, the optical measurements results are converted from pixel to millimeter. The use of this software allows a physical measurement with good accuracy. Samples are subjected to strain rates ranging from 0 to 50% of the initial length. The sketch of Figure 1 shows the marks motion measured on the photograph of a sample subjected to a mechanical stress under an overall strain rate of 8%. Figure 2 shows the photograph of sample placed in the device before and after stress.

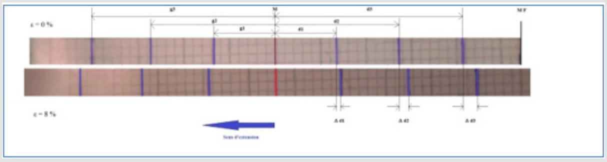

Figure 1: Sample subjected to a mechanical stress under an overall strain rate of 8% (initial distance between the drawn lines = 10mm).

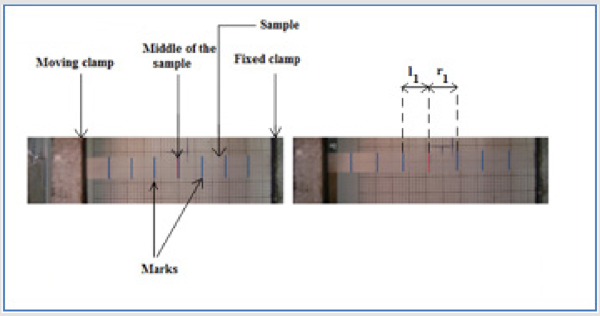

Figure 2: Clamped sample in the device,

a) Before deformation,

b) After deformation.

We defined in this study the true strain as [5,6]:

$$\varepsilon_i = Ln\frac{L_i}{L_{i0}} \qquad (1)$$

So in our case, for both sides of the specimen the deformation between markers is defined as $\varepsilon_{ri} = Ln\frac{L_{rij}}{L_{ri}}$ for the right side; $\varepsilon_{li} = Ln\frac{L_{lij}}{L_{li}}$ for the left side. Where i=1,2 and 3 represent the increasing distance from the center. j=0,1,2...etc; is an index indicating de degree of the applied strain (4, 8,...., 50%).

To optimize the accuracy of the measurements for each curve an average of 5 test pieces has been tested and this for all directions. Also, the curves presented in this work have been plotted with these average values. The standard deviation for each point around the average value never exceeded 5%. Relative true strain: Shown on Figure 3 at three orientations (0°, 45° and 90°) the variation of the relative true strains(ln d_i^j/d_{i0} of the film planes situated on the right [ln r_i^j/r_{i0}] and the left [ln l_i^j/l_{i0})] for an overall strain rate "j" of 50% from its original length. As expected, these curves showed a distinct orientation dependence of the relative true strain. The growth of the curves for the three different distances (r and l) is almost linear. For the 0° stretch, the samples displayed almost the same true strain in both sides ε = 40% so it decreases by 5% in l2 and l3.

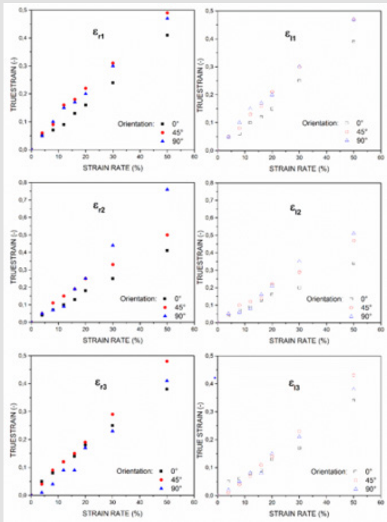

Figure 3: Relative true strain versus strain rate.

(a-c): Right side,

(d-f): Left side for the LDPE films at three directions of 0°, 45° and 90°.

For the 45° stretch, the film behaves similarly to the 0° with higher values, the difference is about of 10% in the different part of the specimen. The relative true elongations of the film for 90° stretch are similar in behavior to 0° and 45°deformation direction with intermediary rates except in "r2" and "l2" which rise to higher values at the end of test ~80% and 50% respectively. However, the deformations in the right side are more pronounced whatever the stretching direction is. However, the film planes deformation for all orientations can be illustrated by the following equation:

$$\varepsilon(t) = \sum_{i=1,\,j=0}^{i=3,\,j=n}\left(\left[\Delta d_i^j / d_{10}\right]\times 100/3\right) = \left[\left(L-L_0\right)/L_0\right]\times 100 \quad (2)$$

Conclusion

By carrying out deformation studies on LDPE films having semi-crystalline morphology, the study of the polyethylene film deformation under controlled deformation rates is allowed. The optical measurements carried out on samples with marks have revealed that relative elongation and true strain are strongly dependent on the angle of the deformations with respective the original orientation direction, they are greater in the 45° stretch followed by 90° then 0°. Also, it has been found that the deformation in the right side is more pronounced. However, it should be noticed that the planes delimited by the marks remain uniform during the whole deformation meaning that the lines of ink remain parallel during the total duration of the experiment.

References

1. Andersson T, Wesslén B, Sandström J (2002) Degradation of low-density polyethylene during extrusion. 1. Volatile compounds in smoke from extruded films. Journal of Applied Polymer Science 86: 1580-1585.
2. Stasiek J (2009) The influence of the conditions of blowing extrusion of polyethylene film on the changes of same properties. Polimery 54: 457-463.
3. Chabira SF, Sebaa M, Huchon R, De Jeso B (2006) The changing anisotropy character of weathered low-density polyethylene films recognized by quasi-static and ultrasonic mechanical testing. J Polym Deg And Stab 91(8): 2006.
4. Zhou H, Wilkes GL (1998) Orientation-dependent mechanical properties and deformation morphologies for uniaxially melt-extruded high-density polyethylene films having an initial stacked. J Mat Sci. 39(2).
5. Cantournet S, Bases physiques contitatives des lois de comportement mécanque.
6. CJA Christensen (2003) TA Ejerton Poly J 44(19).

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