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STUDY OF MECHANICAL BEHAVIOR OF A SEBS BLEND FOR INJECTION MOLDING

D. Juárez, R. Balart, S. Ferrándiz, M.A. Peydró, M. A. Selles
Instituto de Tecnología de Materiales, Universidad Politécnica de Valencia, Alcoy (Spain)
djuarez@mcm.upv.es

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Abstract: This study focuses on a blend from the provider's SEBS extreme hardness (50% Shore-A 5 and 50% Shore-A 90) in order to analyze the miscibility of mixed materials from the storage of 2 references only.
It has been used the thermoplastic elastomer Megol TA® SEBS, whose characteristics make it special due to the wide range of hardness and transparency.
First step is injection of the extreme hardness virgin materials from the provider and the blend in a relation 50%-50% Next step is mechanical characterization of the blend, analyzing hardness, elongation at break and tensile strength.
Finally, results are compared with original values of the materials incorporated.

1. INTRODUCTION.

Styrene - ethylene - butadiene - styrene (SEBS) is a thermoplastic material which combines successfully the properties of an elastomer (rubber) with low costs of processing thermoplastics. Excellent resistance to aging of all compounds based on SEBS and flexibility in the formulation of the polymer allow the production of wide ranges of hardness for different applications in industry.

It is remarkable its range of hardness and elastic modulus, excellent resistance to aging, very good processability at low temperatures and resistant to high temperatures.

Injection molding is one of the different manufacturing processes that use this type of material, which is of great importance for the quantity of products that are made daily.

The main objective of this study is the mechanical characterization of a blend from the provider's SEBS extreme hardness (50% Shore-A 5 and 50% Shore-A 90) in order to analyze the miscibility of mixed materials from the storage of 2 references only.

It is possible to find different works regarding SEBS characterization; Wright, T. et. al. (2002) [1] analyze the improvement of properties of SEBS at high temperatures by modifying its chemical composition. In a similar way, Ghosh, S. et al. (1998) [2] discuss the stages of SEBS modification by using different additives and their influence on morphology and mechanical properties. Arevalillo, A. et. al. (2008) [3] propose an in-depth study of rheological properties of SEBS, focusing the analysis on the low frequency mechanical relaxation flow. Allen, N.A. et al. (2001) [4, 5] study the degradation and stabilization of SEBS and its photo-oxidation (2004).

For the development of this study, we used the SEBS thermoplastic elastomer virgin Megol TA®, whose characteristics make it special due to the wide range of hardness and transparency. The injection of the extreme hardness virgin materials from the provider and the blend in a relation 50%-50% has been made in standardized test pieces into a mold for tensile tests. For the injection has been used for injection Meteor 270/75 Mateu & Solé ®, by injection and crushed five cycles. The mechanical analysis has been developed using the model traction equipment from the manufacturer Elib-30 IBERTEST,S.L. and Shore A hardness equipment from the manufacturer Baxlo.

2. EXPERIMENTAL

2.1 Materials and preparation of specimens

For the development of this study, we used the SEBS thermoplastic elastomer virgin Megol TA® provider's extreme hardness, from the Italian manufacturer Plastiche Applicazioni Industriali, whose characteristics, within the range of SEBS available, make it unique thanks to its range of hardness and transparency.

Properties provided by the manufacturer are shown in Table 1:

Table 1. Properties of virgin Megol TA® SEBS

Properties	Values
Shore hardness range	5-90 A
Compatibility	PP-PE-EVA
Ageing resistance Ozone (72h - 40°C - 200ppcm) Tension = 20 %	Excellent
Weathering	Excellent
Density (g/cm3)	0,88-0,89
Tear strength w.n. (KN/m)	22-44
Tensile modulus 100% elongation (MPa)	1,1-4,2
Tensile modulus 300% elongation (MPa)	1,9-5
Tensile strength (MPa)	6-7,2
Elongation at break (%)	700-550

Next step has been injecting Megol TA® extreme hardness virgin materials from the provider and the blend in a relation 50%-50%.

2.2 Methods and Measurements.

The injection was carried out by injection into a Meteor 270/75 Mateu & Solé ® machine.

The mechanical analysis has been developed using the model traction equipment from the manufacturer Elib-30 IBERTEST,SL and Shore A hardness equipment from the manufacturer Baxlo. All samples were tested at room temperature using a crosshead rate of 50 mm min-1 with a load cell of 100 N. A minimum of ten samples were tested and average values of elongation at break (ductile mechanical property) and tensile strength (resistance mechanical property) were calculated.

3. RESULS AND DISCUSSION.

The processing of the material has been carried out in a prepared pan shaped pieces for tensile test pieces. The experiment began with the injection of the Megol TA® extreme hardness virgin materials.

Experimentation has led to a total of three cycles of injection, spending twenty-one specimens tensile tests and nine hardness testing.

Mechanical characterization testing general conditions for commercial SEBS Megol TA® are shown in table 2:

Table 2- Mechanical characterization testing general conditions for commercial Megol TA® SEBS

Temperature	Room temperature (20-24 ºC)
Crosshead ratio	50 mm / min^{-1}
Load cell	100 N
Minimum specimens tensile tests	10

Table 3 and figure 1 show the results obtained in the traction equipment Elib-30 model with the three materials injected at 185 ºC.

Table 3- Tensile strength for commercial Megol TA® SEBS blends

MIX SEBS 5-90	Tensile strength (Mpa)	Standard Desviation	(%)
100-0	0,76	± 0,02	(± 2,35%)
50-50	1,66	± 0,04	(± 2,21%)
0-100	6,35	± 0,21	(± 3,38%)

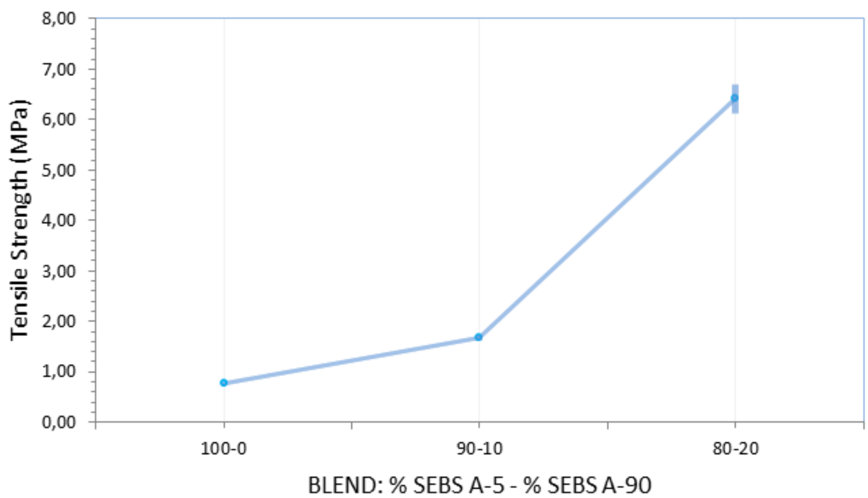

Figure 1 Tensile strength of Megol TA® SEBS blends.

Table 4 and figure 2 show the elongation at break results obtained.

Table 4- Elongation at break for commercial Megol TA® SEBS blends

MIX SEBS 5-90	% elongation	Standard Desviation	(%)
100-0	1740,16	± 40,49	(± 2,33%)
50-50	230,98	± 28,26	(± 12,24%)
0-100	262,02	± 13,50	(± 5,15%)

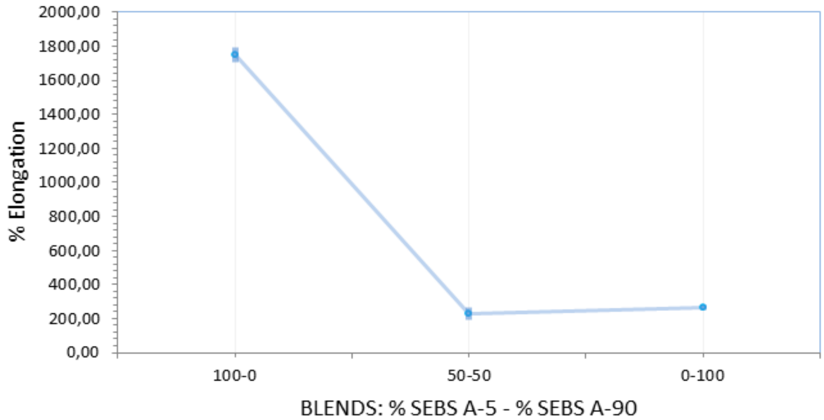

Figure 2 Elongation of Megol TA® SEBS blends.

Table 5 and figure 3 show the hardness results obtained.

Table 5- Shore A hardness for commercial Megol TA® SEBS blends

MIX SEBS 5-90	Shore A Hardness Average	Standard Desviation	(%)
100-0	7,62	± 0,52	(± 6,47%)
50-50	58,75	± 2,71	(± 4,45%)
0-100	89,62	± 0,74	(± 0,84%)

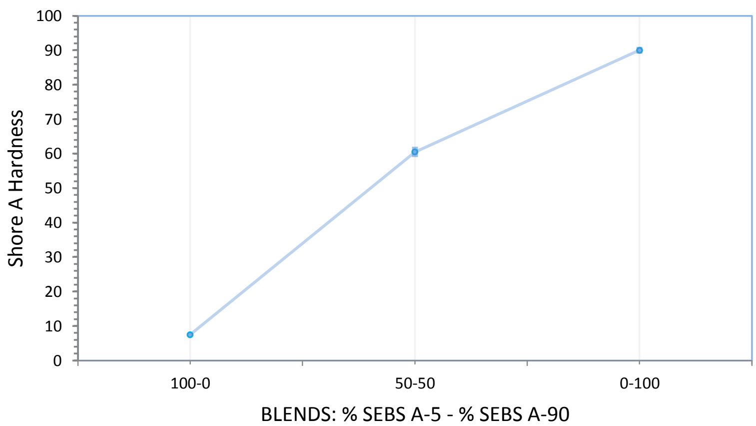

Figure 3 Shore A hardness of Megol TA® SEBS blends.

4. CONCLUSIONS

We studied the mechanical effects of processing blends from the provider's SEBS extreme hardness (50% Shore-A 5 and 50% Shore-A 90) in order to analyze the miscibility of mixed materials from the storage of 2 references only.

It has been used the thermoplastic elastomer Megol TA® SEBS, injecting the extreme hardness virgin materials from the provider and the blend in a relation 50%-50% Next step is mechanical characterization of the blend, analyzing hardness, elongation at break and tensile strength.

Results show good miscibility between the virgin materials, obtaining values for tensile strength and Shore A hardness for the 50% Shore-A 5 and 50% Shore-A 90 blend within the expected range.

5. References

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