

SOCIEDAD POLIMÉRICA DE MÉXICO



Sociedad Polimérica
de México, A.C.



*Riviera Maya, Quintana Roo del 23 al
27 de octubre de 2016.*

XXIX Congreso Nacional de la S.P.M.

COMPARISON OF RHEOLOGICAL PROPERTIES AND IZOD IMPACT RESISTANCE OF PPE/HIPS/SBS BLENDS AND ABS

Erika I. López Martínez^{1*}, Juan A. Arteaga-Bustillos², Mónica E. Mendoza-Duarte¹, Alejandro Vega-Rios¹, Claudia A. Hernández-Escobar¹, E. Armando Zaragoza-Contreras¹, Sergio G. Flores-Gallardo^{1*}---

1. Centro de Investigación en Materiales Avanzados S.C., Miguel de Cervantes 120, C.P. 31136, Chihuahua, Chih. México erika.lopez@cimav.edu.mx, sergio.flores@cimav.edu.mx
2. Universidad Autónoma de Chihuahua, Circuito Universitario s/n, C.P. 31125, Chihuahua, Chih. México.

Introduction

During the last sixty years blending of dissimilar polymers has been a major path to tailor materials with new properties in industry. Depending on the structure and the nature of the dispersed phase in a polymer blend, a wide spectrum of properties can be tailored. Due to the fact that an already existing range of base polymers is used, a large variety of new high-capacity polymers is readily and economically available. The highest market value and the strongest growth rate are predicted for blends based on both polycarbonate (PC) and poly(2,6-dimethyl-1,4-phenylene ether) also referred as polyphenylene ether (PPE). Since PPE and polystyrene (PS) are completely miscible at all molecular weights and concentration ranges, PS or its derivatives (such as high-impact polystyrene (HIPS), styrene-butadiene-styrene (SBS) block copolymers) have been used to improve the processability and toughness of pure PPE. The aim of this work is to evaluate if the PPE/HIPS/SBS blends can compete with the rheological and Izod impact resistance of Acrylonitrile Butadiene Styrene (ABS). ABS is the preferred engineering plastic when it comes to dealing with automotive applications because of its heat and UV resistance, good processability and Impact strength.

Experimental Part

Blends were prepared by using a Brabender Plasticorder internal mixer at a rotor speed of 100 rpm, 280°C and cam blades. PPE and HIPS were first added to the mixer and were allowed to soften. Thereafter, the block copolymer was added and mixed for 3 min. ABS was prepared under the same conditions than the PPE/HIPS blends. The specimens for rheological (Rheometry and DMA) and mechanical (Izod Resistance) measurements were obtained by injection molding at 130 psi of pressure and 310°C.

Results and Discussions

Summary of blends composition (w/w/w) and Izod impact test results are shown in Table 1. In general terms, when increasing the SBS content in the PPE/HIPS blends, the impact resistance is improved because of the toughening effect of elastomers that act as in-situ reinforcing agents since the mode of action of the rubber particles consists generally in initiating deformation mechanism

(crazing, shear failure), which allow high dissipation of energy. The PPE/HIPS blends prepared presented higher impact resistance than ABS.

Table 1. Blends prepared and Izod Impact Resistance obtained

SAMPLE	PPE (wt%)	HIPS (wt%)	SBS (wt%)	Izod Impact Resistance (kJ/m ²)
ABS	-	-	-	19.67
PPE/HIPS	77.77	22.23	-	22.40
PPE/HIPS/SBS416-6%	73.12	20.88	6	25.81
PPE/HIPS/SBS416-12%	68.45	19.55	12	27.81

There are a relationship between rheological properties and the morphology of polymer blends. The elasticity presented at low frequencies plays a role in the phase structure. A higher elasticity is presented, higher tendency of forming a continuous phase it would have. PPE/HIPS blends showed higher elasticity and thermo-mechanical stability than ABS.

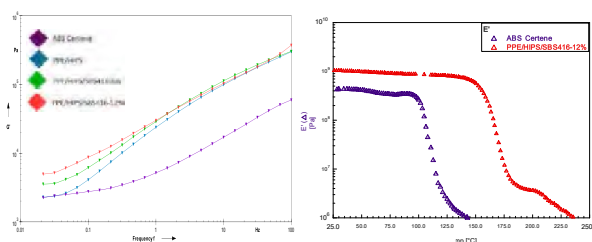


Figure 1. Storage modulus of the blends by Frequency and Temperature Sweep.

Conclusions

The compounding PPE/HIPS and PPE/HIPS/SBS416 blends presented higher Izod-Impact resistance and rheological properties (thermomechanical stability and elasticity) than ABS.

References

1. Adhikari R.; Nepal J. of Science and Technology 2011, 12, 149.
2. Zhang et al.; Composite Science and Technology 2013, 86,122.
3. Puskas J.E. et al.; Polymer 2007,48, 590.