RHEOLOGICAL PROPERTIES OF PET/PC REACTIVE BLENDS

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Poly(ethylene terephthalate)/polycarbonate (PET/PC) blends with and without a cobalt catalyst, at different polymer ratios were prepared in a twin-screw extruder. Rheological behaviour of the blends was discussed, considering the storage (G’) and loss (G’’) moduli. The properties of the blends prepared without catalyst were dictated by PET phase while the catalyzed ones were governed by PC. For all catalyzed blends, an increase on G’ and G’’ was noticed being found the highest values for the PET/PC 50/50 blend, in all frequency range.

Keywords: Rheology, catalyst, PET/PC, reactive blend, properties

Introduction

Poly(ethylene terephthalate) (PET) and polycarbonate (PC) are commercially successful members of the thermoplastic polyester family. PET is worldwide plastic mainly used for beverage bottles due to its excellent barrier and transparency properties. PC has been employed as commodity and engineering plastic in applications that need high impact strength. Blends of them has been developing in order to achieve a new material with their combined properties [1,2]. Rheological property is an important factor in polymer processing hence it determines the better molding process considering the application of the material [3]. As expected, the final properties of the blend are strongly influenced by the size scale of the microstructure leading to a relationship between rheological properties and microstructure [4,5]. The purpose of this study was investigated the role of cobalt acetylacetonate II as catalyst on the rheological properties of PET/PC reactive blends.

Experimental

Materials

PET and PC were supplied by Mossi & Ghisolfi Group and GE Plastics South America, respectively. The MFI of PET and density were 33.0 g/10min and 1.39 g.cm⁻³, respectively. The MFI of PC and density were 2.5 g/10min and 1.2g.cm⁻³, respectively. Commercial cobalt acetylacetonate II was produced by J.T.Baker Chemical Co. was used as catalyst.
**Blending**

Reactive blending of PET/PC at different weight fractions, with and without cobalt acetylacetonate II, a transesterification catalyst, has been performed in a co-rotating twin-screw extruder (L / D = 36 and 22 mm of screw diameter), equipped with vacuum system, at 190-255°C and 150rpm. For the catalyzed blends, a master containing a mixture of PET and catalyst, in an appropriated proportion, was extruded for adding in blend preparation. Before processing, the water was removed from polymers by drying at 120°C, during 8 hours, in order to prevent hydrolysis during melt processing. After blending, the extrudate was cooled in water (30°C) and pelletized.

**Rheology measurements**

The rheological properties were conducted in a dynamic oscillatory rheometer, model Rheometrics AR2000, equipped with parallel plates (D=25 mm, gap=1 mm), in the frequency range from 350 to 10 rad.s⁻¹, at 270°C, under nitrogen atmosphere. Before the rheological measurements, all materials were dried, at 120°C, during 8 hours.

**Results and discussion**

Figure 1 shows the variation of the G’ as function of the frequency for catalyzed and uncatalyzed blends, respectively. In the latter, the G’ of neat PC is higher than PET one. At lower frequencies, the G’ values of the blends are sit between the homopolymer ones but lay below of the neat PET, at higher frequencies. For the catalyzed blends (Figure2), the G’ of the PET was also lower than PC one. Concerning the blends, the G’ appeared between those parent homopolymers. The addition of the catalyst brings about an increase of the G’ in all frequency range which was attributed to the occurrence of exchange reactions, during the blend processing.

![Figure 1- Storage modulus of PET/PC blends without catalyst at 270°C](image-url)
Figure 2- Storage modulus of PET/PC blends with catalyst at 270ºC

Figure 3 presents the variation of the G’’ versus frequency of the uncatalyzed PET/PC blends. Among the materials, PC showed the highest value of the G’’. General speaking, at higher frequencies, all blends exhibited G’’ values lower than PET one. Conversely, only the 50/50 blend showed G’’ value higher than PET one, at low frequencies. Regarding the G” behavior of the catalyzed blends (Figure 4), it was noticed that again PC showed the highest value of the G” and that the 50/50 blend presented the highest one. The G” blends is also placed between those neat component ones, in full range of frequency. Similarly to G’, the presence of the catalyst also gave rise the enhance the loss modulus.

Figure 3- Loss modulus of PET/PC blends without catalyst at 270ºC
Conclusion

The results showed that the rheological properties were dependent to the presence of the catalyst. Both the storage and loss moduli showed a sharp increasing which was attributed to the occurrence of exchange reactions during the blending process. The presence of cobalt catalyst led to the growth of the level of the transesterification bringing about an increase of the interaction into the interface of matrix and dispersion phase.

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