

RECYCLED PET/PP-EP BLENDS: INFLUENCE OF COMPATIBILIZER AND/OR MONTMORILLONITE CLAY ADDITION

Adriana M. C. Souza^a, Ana Paula L. Quiles^a

^a *Centro Universitário da FEI, 3972 Humberto de Alencar Castelo Branco, São Bernardo do Campo SP CEP: 09850-901, Brazil
(amcsouza@fei.edu.br)*

Introduction

Poly(ethylene terephthalate) (PET) is one of the most recycled plastics in the world. However, it is known that recycled PET presents inferior properties as compared to the virgin PET and that mixing with polyolefins can be an alternative to improve its properties¹. Unfortunately, PET and polyolefins are immiscible resulting in a blend with poor adhesion among its phases. The compatibility of these blends can be improved commonly by reactive compatibilization processes¹. Nowadays, some works have been shown that montmorillonite clay can act as a compatibilizer for polymer blends². In this work, the morphology and mechanical properties of recycled PET/polypropylene (ethylene-propylene) heterophasic copolymer (R-PET/PP-EP) blends with addition of poly(ethylene-*co*-acrylic ester-*co*-glycidyl methacrylate) (P(E-*co*-MA-*co*-GMA)) and/or montmorillonite clay (MMT) was investigated.

Methods

R-PET/PP-EP blends were prepared in a twin-screw extruder. Both the genuine blends and the ones to which P(E-*co*-MA-*co*-GMA) (5wt.%) and/or MMT (5wt.%) was added were prepared in two steps. The compatibilizer and/or MMT was first mixed with the minor phase (PP-EP) and then blended with the matrix material (R-PET). Samples for tensile, impact tests and also morphological analysis were obtained by injection molding. Tensile and Charpy impact tests were performed according to standard conditions (ASTM D-638 and ASTM D256-D, respectively). The blend morphologies were characterized by scanning electron microscopy (SEM). The average dispersed phase diameter was obtained by measuring the diameter of 500 particles approximately. X-ray diffraction (XRD) analysis were performed using a CrK α radiation ($k = 2.28 \text{ \AA}$) with a step size of $0.08^\circ/\text{min}$ from $2\theta = 1$ to 10° .

Results

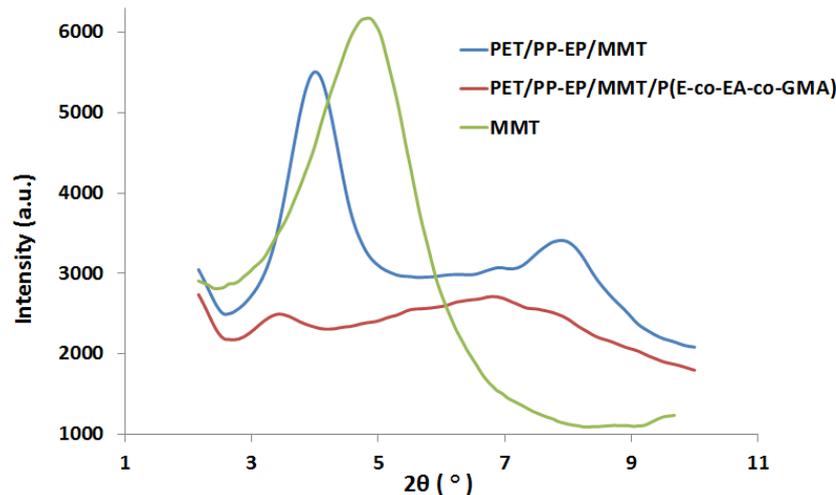


Figure 1: X-Ray diffraction of MMT and PET/PP-EP blends containing MMT.

Table 2: Quantification of the morphology, tensile and impact properties of PET/EP blends.

Blend	Diameter Average (μm)	Young Modulus (GPa)	Tensile strength (MPa)	Elongation at break (%)	Impact resistance (J/m)
PET / PP-EP 90/10	$1,50 \pm 1,24$	$2,4 \pm 0,1$	$46,0 \pm 0,5$	$55,7 \pm 28,8$	$18,0 \pm 0$
PET / PP-EP / MMT 85/10/5	$0,89 \pm 0,46$	$2,8 \pm 0,1$	$46,7 \pm 0,5$	$36,5 \pm 17,0$	$27,0 \pm 0$
PET / PP-EP / P(E-co-EA-co-GMA) 85/10/5	$1,21 \pm 0,80$	$2,1 \pm 0,1$	$41,5 \pm 0,3$	$122,6 \pm 34,3$	$27,0 \pm 0$
PET / PP-EP / MMT / P(E-co-EA-co-GMA) 80/10/5/5	$1,01 \pm 0,66$	$1,1 \pm 0,4$	$38,0 \pm 0,2$	$4,9 \pm 0,9$	$18,0 \pm 0$

Conclusions

XRD analysis indicated that there was incorporation of polymer in MMT clay galleries. The addition of P (E-co-MA-co-GMA) or MMT separately promoted a decrease of the dispersed phase size. The addition of MMT in R-PET/PP-EP blend resulted in an increase of apparent Young modulus, tensile strength and impact resistance and a decrease of elongation at break. The addition of P (E-co-MA-co-GMA) resulted in an increased impact strength and reduction of other properties. The mechanical properties show a decrease when MMT and P (E-co-MA-co-GMA) are added simultaneously.

References

1. El-Nashar D.E., Maziad N.A., Sadek E.M., J. Appl. Polym. Sci. **110**: 1929, 2008.
2. Ray S.S.; Bandyopadhyay J.; Bousmina M. Macromol. Mat. Eng. 292: 729, 2007.