

Mechanical properties of poly (butylene adipate-co-terephthalate) reinforced with Cloisite 15A

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Abstract

Polymeric composites of poly (butylene adipate-co-terephthalate) were reinforced with commercial organophilic montmorillonite clay Cloisite and tensile tests provided mechanical properties. The study of the Elastic modulus of pure PBAT (poly (butylene adipate-co-terephthalate)) and different composites demonstrates that Cloisite presents potential for reinforcement of PBAT.

Key words:

Polymer composites, Organophilic clay, Elastic modulus.

Introduction

In recent literature, the usage of organophilic clays to obtain nanocomposites with superior mechanical properties has been widely investigated¹. The advantage of PBAT is that it is a synthetic copolymer that is biodegradable in a composting environment². PBAT is obtained through the polymerization of the oligomeric diester of adipic acid/butanediol and terephthalic acid/butanediol¹. However, the application of PBAT in polymer composites has yet to be more explored in literature. In this sense, research on the properties of PBAT composites are an essential step for future use.

This work aims to study the influence on mechanical properties when different concentrations of the organophilic clay Cloisite 15A are added to PBAT. This is possible through the performance of tensile tests.

Results and Discussion

The mixtures were prepared in a high shear mixer ((MH Equipment, Ltd., 100H). The melted mixture was molded in a hydraulic press (MH, Q/F MOT. 8 TON) at 150 °C, and further cooled for the tensile tests in a universal machine (MTS, DL 2000) according to ASTM D638-10. The equipment stated was used from LAPOL (Polymer Processing Laboratory, Faculty of Chemical Engineering, State University of Campinas).

Chart 1. Mechanical properties of PBAT-P and composites.

Sample	Elastic modulus (MPa)	Stress at break (MPa)	Elongation at break (%)
PBAT-P	59.6	22.4	677.3
PBAT/Cloisite-3%	68.1	21.0	664.4
PBAT/Cloisite-5%	72.4	22.2	787.9
PBAT/Cloisite-7%	77.4	19.1	779.5

Through Chart 1, it is possible to observe that the elastic modulus is improved when is added to PBAT and this value

is raised when higher concentrations of Cloisite is used. An increase in 29,9% in the value of the Elastic modulus is obtained when 7% in mass of the composite corresponds to Cloisite. The stress-deformation graphics were plotted for all samples, as Image 1.

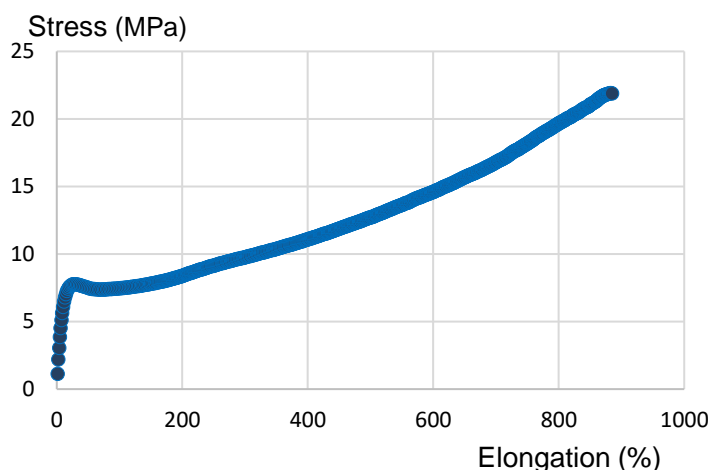


Image 1. Stress (MPa) per elongation (%) for the sample PBAT/Cloisite-5%.

Moreover, results of XRD (X-Ray Diffractions) analysis indicated that there is intercalation of the reinforcement on the polymeric matrix.

Conclusions

The results of this research lead to the conclusion that the clay Cloisite 15A has potential as a reinforcement in PBAT composites, observed through the increase in the Elastic modulus. Furthermore, the benefit that the polymer matrix is biodegradable is also a key factor for sustainable efforts in polymer science and technology. In this sense, this project offers valuable information for future applications of PBAT composites.

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¹Morales, A. R., et al. *Polímeros: Ciência e Tecnologia*. 2010, 20.1.

²Pinheiro, I.; Morales, A. R.; Mei, L.; *Cellulose*. 2014, 21.6, 4381-4391