폴리락타이드와 유기개질된 montmorillonite의 합성

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Preparation of PLA/organically Modified Montmorillonite Nanocomposites

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1. Introduction

In recent years there has been a growing interest in the use of biodegradable polymers for packaging materials in order to reduce the environmental pollution caused by plastic wastes[1]. Polylactic acid or Polylactide(PLA) is a biodegradable, thermoplastic, aliphatic polyester derived from renewable resources with excellent properties[2,3]. However, its lower thermal stability and mechanical properties limite the further applications[4]. One successful method for improving these properties is to intercalate polymers into the silicate galleries. In this paper, we prepared PLA/montmorillonite nanocomposites via melt blending intercalation and study the morphology of composite by SEM.

2. Experimental section

2.1 Materials

PLA was supplied By Huvis Co., Korea, and was used after being dried under vacuum at 70°C. The organically modified montmorillonite(C18-MMT) used in the study was supplied by Zhejiang Fenghong Clay Co., Ltd., China. and was synthesized by replacing Na+ in montmorillonite of a cation-exchange capacity of 110 mequiv/100g with octadecylammonium cation by ion exchange reaction. As a reference, unmodified MMT was also from the same company.

2.2 Preparation of Nanocomposites

Organoclay and PLA were first dry-mixed by shaking them in a bag and then extruded by a twin-screw extruder at a rotational speed of 150 rpm. The temperature profiles of the barrel were 150-230–230–230–230-240℃ from the hopper to the die. The extrudate was drawn at a ratio of 10. The pure PLA extruder was transparent and the nanocomposite extruder appeared from very light gray to a little dark gray.

Table 1. Composition of various PLA/clay nanocomposites based on PLA, C18-MMT or unmodified MMT.

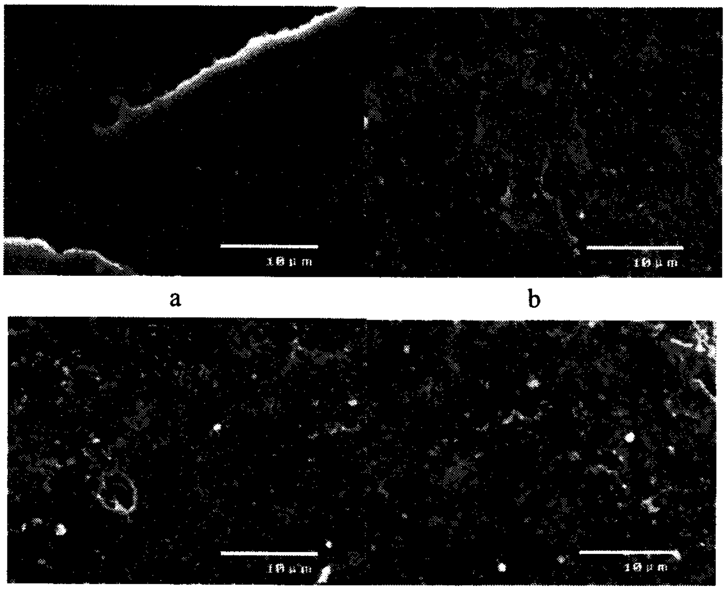
Sample	Composition, wt%		
	PLA	C18-MMT	Unmodified MMT
PLACN1	99	1	
PLACN2	95	5	
PLACN3	93	7	
PLAUN	93		7

To investigate the effect of long alkyl group on the dispersion of the silicate layers in the PLA matrix, PLA/unmodified MMT nanocomposite was also prepared in the same method above. The composition of all the samples was listed in the Table 1. Hereafter, the product PLA/C18-MMT nanocomposites were abbreviated as PLACNsand PLA/unmodified MMT nanocomposites were abbreviated as PLAUNs.

The morphology of samples' fracture surface (fractured in liquid nitrogen) were then observed by scanning electronic microscope (SEM) (JEOL JSM-6360A).

3. Results and discussion

Figure 1 shows the facture surfaces of PLACNs and PLAUN. From pictures, we can see that (1) a complete homogeneous disperson of C18-MMT can be got in the PLACNs, (2) the particles of dispersed phase tend to increase with increasing C18-MMT contents, (3) the dispersion of C18-MMT in PLACNs is much better than that in PLAUN and unmodified MMT tends to aggregate at a certain extent.



a b

c d

Figure 1. Scanning Electron Microscopy (SEM) images of facture surface of samples: a, PLACN1, b, PLACN2, c, PLACN3, d, PLAUN

4. Results

We successfully prepared PLA/C-18 MMT nanocomposites. As shown in Figure 1, we found that the dispersion of C18-MMT in PLACNs was much better than that in PLAUN and unmodified MMT tended to aggregate at a certain extent.

References

[1] Rakeuchi, H. and Cohen, C. *Macromolecules*, **1999**, *32*, 6792-6799.

[2] Tsuji, H.; Ikada, Y. *J. Appl. Polym. Sci.*, **1998**, *67*, 405.

[3] Martin, O.; Averous, L. *Polymer*, **2001**, *42*, 6209.

[4] Sinha Ray, S.; Maiti, P.; Okamoto, M.; Yamada, K., Ueda, K. *Macromolecules*, **2002**, *35*, 3104-3110.