

Properties and Morphologies of PVC/Nylon Terpolymer Blends

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ABSTRACT: A new kind of blends of polyvinyl chloride (PVC)/nylon terpolymer was reported in this article. Two compatibilizers were used in this study: one is a terpolymer of ethylene-*n*-butyl acrylate-monoxyde (EnBACO); the other is terpolymer of EnBACO grafted with maleic anhydride (EnBACO-*g*-MAH). The observation of scanning electron microscope (SEM) reveals that the PVC/nylon terpolymer blends have a two-phase structure; and the nylon terpolymer phase is the continuous phase, and PVC domains in the PVC/nylon terpolymer/EnBACO-*g*-MAH blends have fine dispersion over a broad range of the PVC/nylon terpolymer ratio. EnBACO-*g*-MAH is more compatible with the nylon terpolymer than EnBACO. EnBACO and EnBACO-*g*-MAH have different effects on the glass transition temperatures of the PVC phase and nylon terpolymer phase in the blends. The notched Izod impact strength, tensile strength, elongation at break, Vicat softening temperature (VST), and melt flow index (MFI) critically depend on PVC/nylon terpolymer ratio, the kinds and concentration of the compatibilizers. The PVC/nylon terpolymer/EnBACO-*g*-MAH blends display a good combination of high toughness, high flowability, and high VST under low load. © 2001 John Wiley & Sons, Inc. *J Appl Polym Sci* 80: 2823–2832, 2001

Key words: PVC; nylon; terpolymer; blend; compatibilizer; EnBACO; EnBACO-*g*-MAH

INTRODUCTION

In practice, polymer blending aims at securing sets of specific properties required for application. The only way to reach such a balance of properties is by combining typical properties of several polymers into a multicomponent system. Polymer blending was also used to gain direct economy by diluting expensive engineering resins with commodity ones. Mixing two or more polymers usually results in phase-separated systems. The performance of multiphase blends depends not only on the ingredients and their concentration, but

also on their morphology and the nature of the interface between the phases.¹ Unfavorable interactions between the molecular segments of the components result in a high interfacial tension, which makes it difficult to disperse the components properly during mixing. Moreover, poor interfacial adhesion in the solid state may cause mechanical failure and brittle behavior. The addition of some graft or block copolymers as compatibilizers is effective to solve this problem. A compatibilizer is usually a polymer made up of chemical distinct sections, some of which are miscible with one component and some with the other. The enhanced adhesion between the phases results in better dispersion and smaller domains in the melt, and facilitates the stress transfer in the solid state, hence improving the

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mechanical properties of blends. Small quantities of compatibilizers are usually used in the polymer blend. Large quantities of copolymers are also used in blends of two brittle, immiscible polymers that must be not only compatibilized but also toughened.¹⁻²

Polyvinyl chloride (PVC) is a commodity plastics with many good properties such as nonflammability, relatively low-cost and formulating versatility. But the poor thermal stability in processing and the low toughness and heat-softening temperature are obstacles for PVC to expand its application. Polymers miscible with PVC are used for plasticization and heat-distortion enhancement. Partial and immiscible polymers are used for impact modification and processing aids.³ It is tough work to blend PVC with nylon polymers because of differences of processing temperature and crystallinity. PVC/nylon blends including PA6/PVC, PA11/PVC, PA12/PVC, PA1212/PVC, and proprietary polyamide/PVC were commercialized by Du Pont Packaging & Industrial Polymers³⁻⁷ and Cybertech Polymers.⁸ Amorphous nylon that has a T_g (glass transition temperature) of 127°C⁴ was also reported to be blended with PVC. Ethylene copolymers are used in these blends as compatibilizers. New PVC blending technologies are also used to avoid the decomposition of PVC.³⁻⁸ The ethylene copolymer is blended with the nylon previously at the temperature above melting point of nylon, then the binary blend is blended with PVC below 200°C. These blends display an attractive combination of properties including the flame resistance and toughness of lightly plasticized PVC and chemical resistance and low-temperature flexibility of nylon. These blends also display outstanding abrasion resistance, strength, and processability.⁶ But to our knowledge, few detailed publications concerning the morphologies and properties of PVC/nylon blends have been reported.

A new kind of blends of PVC/nylon terpolymer was developed in our study. The nylon terpolymer has low crystallinity, low melting temperature, and a T_g of 40–50°C. Two ethylene copolymers commercialized by the Du Pont Corporation, EnBACO with a trade name of Elvaloy HP441 and EnBACO-*g*-MAH with a trade name of Fusabond MG423D, were used in the blends as compatibilizers. The two copolymers having carbonyl groups are compatible with PVC, which can be used as plasticizers for PVC. The carbonyl groups are believed to form a hydrogen bond with nylon molecules. If the copolymers are grafted with ma-

leic anhydride (MAH), the resulting succinic anhydride moiety shows reactivity to amines of nylon molecules.^{2,4,7} Therefore, EnBACO and EnBACO-*g*-MAH should be good compatibilizers for PVC/nylon blends from the viewpoint of chemistry, and EnBACO-*g*-MAH should have higher compatibilizing efficiency than EnBACO in PVC/nylon blends.

In this study, the impact strength, tensile, and dynamic mechanical properties, flowability, and VST of the blends were tested. The morphologies were characterized by SEM and dynamic mechanical thermal analysis (DMTA).

EXPERIMENTAL

Materials and Specimen Preparation

Suspension PVC (PVC WS-800, $\overline{DP} = 800$) was produced by Shanghai Chlor-Alkali Chemical Co. Ltd., (P.R.C). Nylon terpolymer (NT-150), copolymerized by caprolactam (10 wt %), salt of nylon 66 (20 wt %) and salt of nylon 1010 (70 wt %), was produced by the Shanghai Cellulose Chemical Co., Ltd. (China). The melting range of the nylon terpolymer is 140–150°C. The compatibilizers, EnBACO (Elvaloy HP441) and EnBACO-*g*-MAH (Fusabond MG423D) were produced by the Du Pont Co. (U.S.A.). The MAH content of EnBACO-*g*-MAH was 0.5–1 wt %. The organic tin stabilizer, calcium stearate and paraffin were industry-grade products.

PVC 100 phr, organic tin stabilizer 3 phr, calcium stearate 1.5 phr, and paraffin 0.2 phr were premixed together in a high-speed mixer for 10 min to form the PVC compound. Nylon was dried at 73°C for 48 h in a vacuum oven. The PVC compound, compatibilizer, and nylon terpolymer were melt blended in a mixing chamber of the Hakke Rheometer 90. The mixing temperature was set at 180°C, and the rotor speed was 50 rpm, the mixing time was 8 min. The blends thus prepared were molded into sheets of 1 and 3 mm in thickness by pressing in laboratory press at 180°C and 20 MPa for 10 min, followed by cooling to room temperature at 5 MPa.

Morphology Observation

An Hitachi S-2150 scanning electron microscope was used to observe the surface morphology of the specimens that were fractured under cryogenic condition with liquid nitrogen. Tetrahydrogenfu-

ran (THF) was used to etch the PVC phase on the fractured surfaces for different times, depending on the PVC content in these blends. The cryofractured and etched surfaces were coated with thin layers of gold before observation.

Dynamic Mechanical Properties

Dynamic mechanical thermal analysis (DMTA) data, storage modulus (E'), loss modulus (E''), and loss tangent ($\tan \delta$), were obtained under a multiwave dynamic tension mode at 10 Hz by a Rheometric Scientific™ DMTA IV. The specimen dimension was $20 \times 4 \times 1 \text{ mm}^3$.

Notched Izod Impact Strength

Notched Izod impact tests were performed at room temperature and -30°C by an impact tester of RAY-RAN Co. (UK), according to ASTM D256-97. The specimen dimension was $63.5 \times 12.7 \times 3 \text{ mm}^3$. The specimens for impact tests at -30°C were kept in cryogenic condition at -30°C for 24 h.

Tensile Properties

Tensile tests were performed using 1-mm samples at a crosshead speed of 50 mm/min by an Instron tensile tester according to ASTM D638M-93/89.

MFI

Melt flow index tests were performed at 190°C under the load of 10 kg by MFI tester of the Shanghai Sierda Factory of Scientific Instruments according to ASTM D1238-88.

VST

Vicat softening temperatures were measured under the load of 1 kg by a Vicat softening temperature tester of the RAY-RAN Co. (UK) at heating rate of $50^\circ\text{C}/\text{h}$. The specimen thickness was 3 mm.

RESULTS AND DISCUSSION

Morphology Observation

Mechanical properties of a multiphase polymer blends are directly related to their microstructure, especially the size and shape of the dispersed phase. Figure 1 shows SEM micrographs

of PVC/nylon terpolymer blends etched by THF (solvent for PVC).

As shown in Figure 1(a)–(c), it can be seen that the PVC phase is dispersed phase and the nylon has a continuous network structure in the PVC/nylon terpolymer (3/1) blends. The holes on the fractured surfaces show the dispersed PVC phase etched by THF. The presence of EnBACO-*g*-MAH and EnBACO in the blends leads to the reduction in the size of the dispersed PVC and their uniform distribution. From Figure 1(a), it can be seen that many small holes are embedded on the surfaces of bigger holes, these smaller holes cannot be seen in Figure 1(b) and Figure 1(c). These small holes with average diameter about $1 \mu\text{m}$ can be regarded as the PVC primary particles left on the surfaces. This may indicate that low fusion level is achieved⁹ in the PVC phase of the binary PVC/nylon terpolymer blends in the absence of EnBACO-*g*-MAH and EnBACO. Therefore, it is reasonable to conclude that the poor plasticization and compatibilizing efficiency of the blend results in the poor dispersion of PVC phase.

SEM micrographs are shown respectively in Figure 1(d)–(i) at PVC/nylon terpolymer ratios of 1/1 and 1/3, and nylon terpolymer becomes the real matrix of these blends. As can be seen, the PVC domains in the PVC/nylon terpolymer/EnBACO-*g*-MAH blends achieves fine dispersion, and the domain sizes are the smallest among the three blends as shown in Figure 1(d)–(i). It indicates that EnBACO-*g*-MAH has higher compatibilizing efficiency than EnBACO in PVC/nylon terpolymer blends.

Dynamic Mechanical Properties

DMTA spectra of PVC and its blends with EnBACO or EnBACO-*g*-MAH are shown in Figure 2. Glass transition temperatures are determined as the temperature is at maximum of $\tan \delta$. We consider that in the conditions this method gives the most reliable and reproducible results. The curve of $\tan \delta$ vs. temperature for PVC exhibits two relaxation peaks, which is similar to that which has been reported in other literature.¹⁰ The first relaxation peak is a very broad one at temperatures between -70°C and 10°C , and is attributed to a twisting motion of a chain segment about its long axis, i.e., segment flipping, by Havriliak and Shortridge,¹⁰ and this peak is very hard to read accurately so is not used in this study. The high-temperature relaxation peak is attributed to the transition from the glassy to the

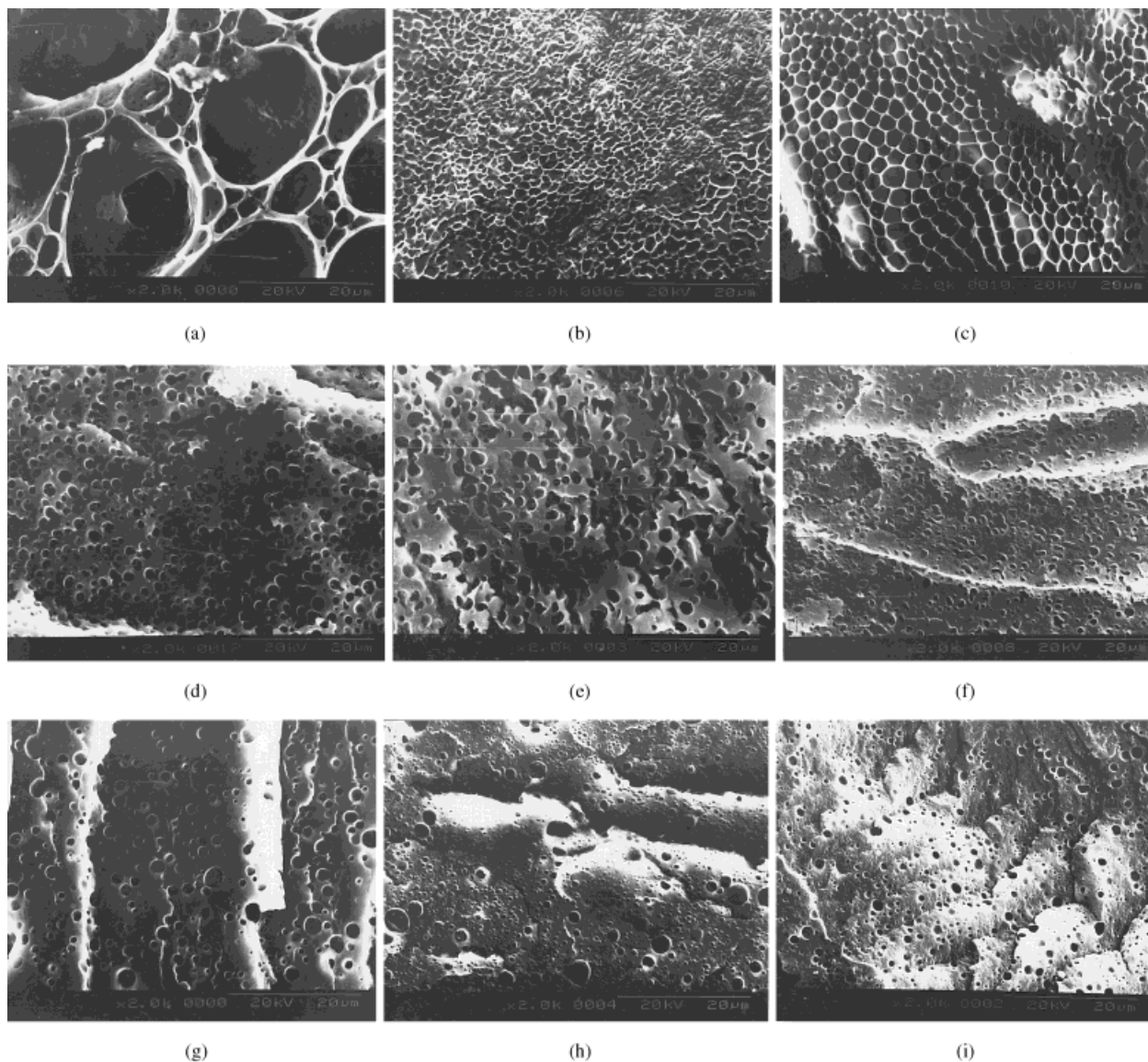


Figure 1 SEM photographs of PVC/nylon terpolymer blends. (a) PVC/nylon terpolymer = 75/25; (b) PVC/nylon terpolymer/EnBACO = 75/25/14. (c) PVC/nylon terpolymer/EnBACO-*g*-MAH = 75/25/14. (d) PVC/nylon terpolymer = 50/50. (e) PVC/nylon terpolymer/EnBACO = 50/50/14. (f) PVC/nylon terpolymer/EnBACO-*g*-MAH = 50/50/14. (g) PVC/nylon terpolymer = 25/75. (h) PVC/nylon terpolymer/EnBACO = 25/75/14. (i) PVC/nylon terpolymer/EnBACO-*g*-MAH = 25/75/14.

viscoelastic state. The curve of $\tan \delta$ vs. temperature of binary PVC (100 phr)/compatibilizer (EnBACO or EnBACO-*g*-MAH, 14 phr) blend exhibits only one broad relaxation peak without the relaxation peak, corresponding to the glass transition temperature of EnBACO-*g*-MAH and EnBACO, which is shown in Figure 2. The presence of EnBACO or EnBACO-*g*-MAH leads to a slight shift of the relaxation peak to low temperature and to the broadening of the peak, which

is attributed to the compatibility of PVC and EnBACO or EnBACO-*g*-MAH. The storage modulus exhibits a sharp dropoff to about 10 MPa at the end of the transition, which leads to the softening of the materials when the temperature rises. The two compatibilizers also lead to lower E' , as shown in Figure 2.

DMTA spectra of pure nylon terpolymer and the binary blends of nylon terpolymer and EnBACO or EnBACO-*g*-MAH are shown in Fig-

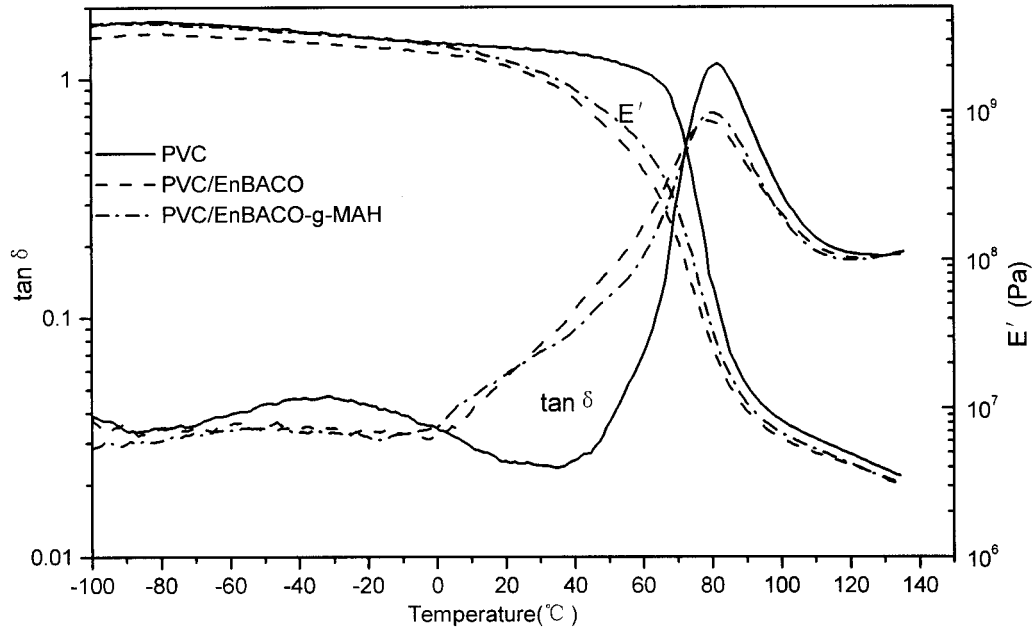


Figure 2 Temperature dependence of $\tan \delta$ and storage modulus E' of PVC, PVC/EnBACO (100/14) blend, and PVC/EnBACO-MAH (100/14) blend.

ure 3. The curve of $\tan \delta$ vs. temperature for a pure nylon terpolymer exhibits two relaxation peaks. The α -transition corresponding to the glass transition of the amorphous part of the ny-

lon terpolymer is localized near 40°C, the low-temperature transition peak of nylon terpolymer at about -60°C is the β -transition, which might be related to the presence of small amounts of

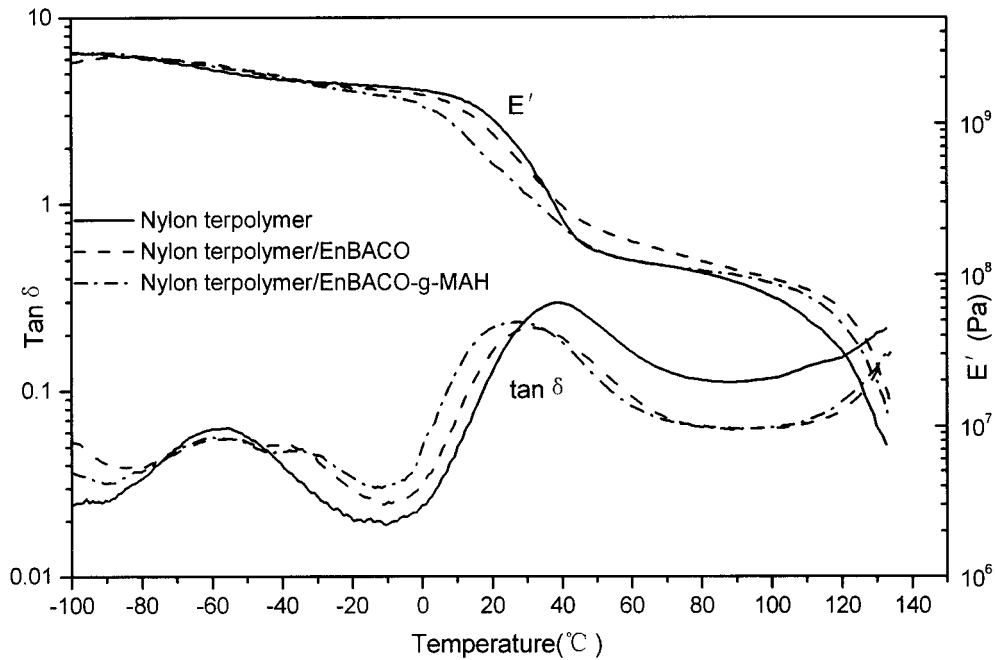


Figure 3 Temperature dependence of $\tan \delta$ and storage modulus E' of nylon terpolymer, nylon terpolymer/EnBACO (100/14) blend, and nylon terpolymer/EnBACO-MAH (100/14) blend.

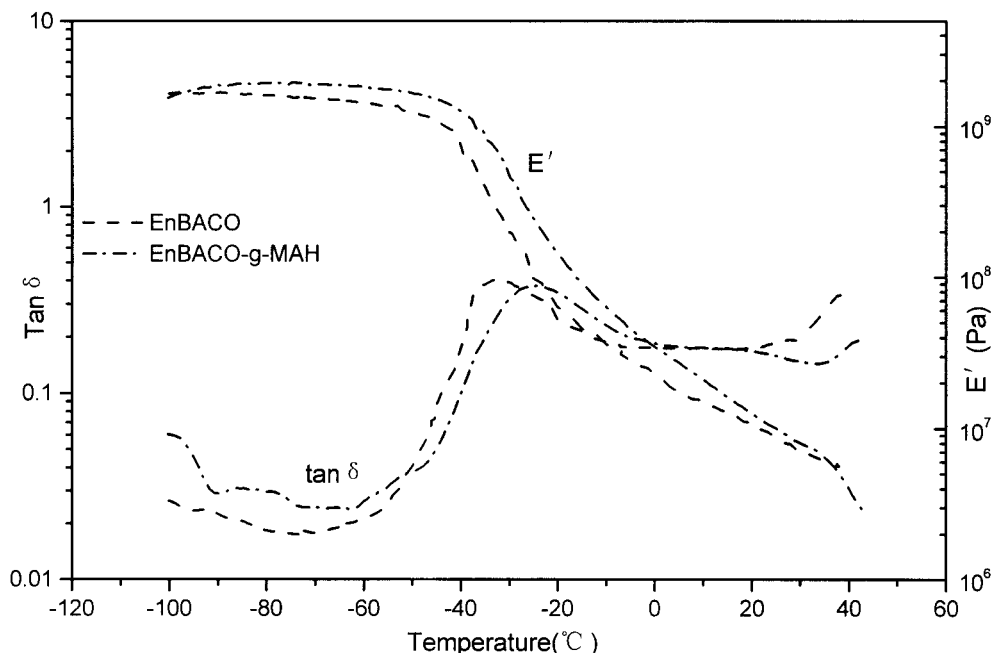


Figure 4 Temperature dependence of $\tan \delta$ and storage modulus E' of EnBACO and EnBACO-MAH.

water or monomer as reported for nylon 6.¹¹ The range of the glass transition temperature of nylon terpolymer is 10–50°C according to the curve of E' , at the end of which the E' decreases to about 100 MPa. As shown in Figures 2 and 3, the E' of nylon terpolymer at the temperature above T_g is much higher than that of PVC due to the presence of crystalline of the nylon terpolymer. It is related to the higher VST of nylon terpolymer under 1 kg load nylon terpolymer than that of PVC, as shown in Figure 10. Above 120°C, nylon terpolymer exhibits a sharp dropoff in E' , which is attributed to the melting of the crystalline phase. The curve of $\tan \delta$ vs. the temperature of the nylon terpolymer/EnBACO or nylon terpolymer/EnBACO-*g*-MAH blend exhibits three relaxation peaks. Except for the two peaks associated with the relaxation of nylon terpolymer, the third peak is caused by EnBACO or EnBACO-*g*-MAH, which has a glass transition temperature between -50°C to -10°C as shown in Figure 4. It indicates that nylon terpolymer is immiscible with EnBACO or EnBACO-*g*-MAH. From $\tan \delta$ vs. temperature curves in Figure 3, it is also observed that the peak of the glass transition of the nylon terpolymer in the nylon terpolymer/Evaloy or nylon terpolymer/EnBACO-*g*-MAH blend shifts to the low temperature due to the compatibilization of nylon terpolymer with EnBACO or EnBACO-*g*-MAH to

some extent. The T_g of nylon terpolymer in the nylon terpolymer/EnBACO-*g*-MAH blend is lower than in the nylon terpolymer/EnBACO blend, as shown in Figure 3, and EnBACO has lower T_g than EnBACO-*g*-MAH, as shown by $\tan \delta$ vs. temperature curves of EnBACO and EnBACO-*g*-MAH in Figure 4. Therefore, it can be thought that EnBACO-*g*-MAH is more compatible with nylon terpolymer than EnBACO.

DMTA spectra of PVC/nylon terpolymer (50/50) blends were shown in Figure 5. As can be seen, the curve of $\tan \delta$ vs. temperature of the PVC/nylon terpolymer blend exhibits three relaxation peaks. The first relaxation transition at about -60°C may be attributed to the β -transition of nylon terpolymer. The second peak at about 25°C and the last peak at about 80°C corresponds to the glass transition of nylon terpolymer and PVC, respectively. As the curves of $\tan \delta$ vs. temperature of nylon terpolymer/PVC blends show, the presence of EnBACO or EnBACO-*g*-MAH causes the PVC glass transition peak to shift to low temperature. For PVC/nylon terpolymer/EnBACO blends, there is only one broad relaxation peak of $\tan \delta$ in the temperature range of 0–95°C, as shown in Figure 5. The presence of EnBACO or EnBACO-*g*-MAH in the PVC phase leads to a broad $\tan \delta$ peak and slight shift to low temperature, and the presence of EnBACO or

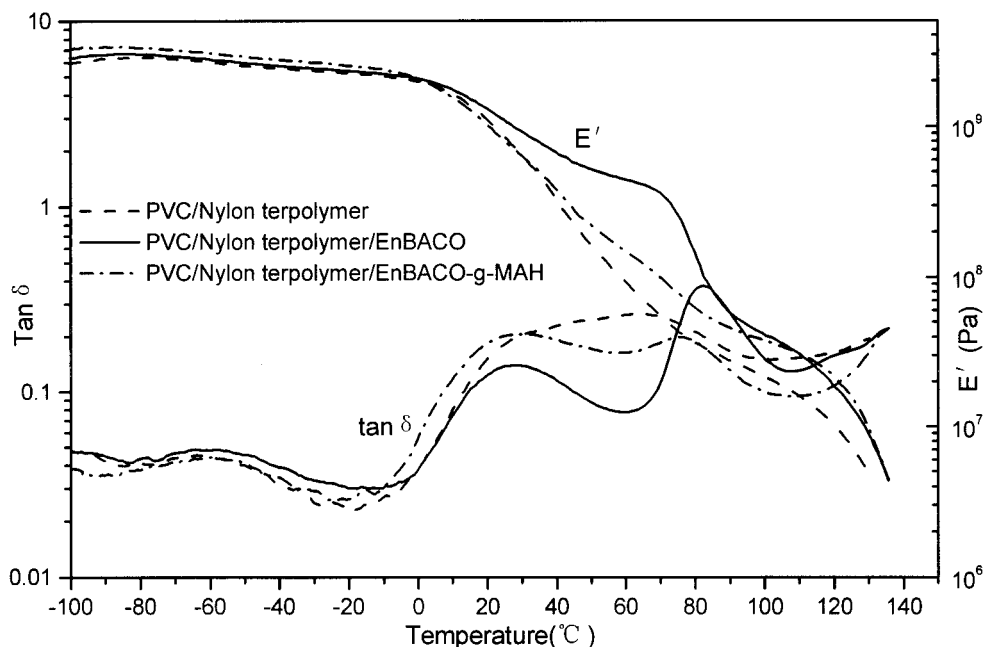


Figure 5 Temperature dependence of $\tan \delta$ and storage modulus E' of the PVC/nylon terpolymer (50/50) blend, the PVC/nylon terpolymer/EnBACO (50/50/14) blend, and the PVC/nylon terpolymer/EnBACO-MAH (50/50/14) blend.

EnBACO-*g*-MAH in nylon terpolymer leads to a shift of $\tan \delta$ to low temperature. These two factors constitute the basis of the characteristics of the change of $\tan \delta$ vs. temperature for the PVC/nylon terpolymer/EnBACO or the PVC/nylon terpolymer/EnBACO-*g*-MAH blend. Another possible factor influencing the $\tan \delta$ values may be the improved compatibility of the PVC/nylon terpolymer blend compatibilized by EnBACO or EnBACO-*g*-MAH.

Mechanical Properties and Flowability

PVC is a typical brittle material, and needs to be toughened. The nylon terpolymer exhibits low ri-

gidity at room temperature, with a notched Izod impact strength of 143 J/m. Table I shows that the impact strength at room temperature of the PVC/nylon terpolymer blends increases generally with decreasing the PVC/nylon terpolymer ratio from 3/1 to 1/3. The blends have the impact strength in the increasing order: PVC/nylon terpolymer, PVC/nylon terpolymer/EnBACO, PVC/nylon terpolymer/EnBACO-*g*-MAH, when the PVC/nylon terpolymer ratio is fixed. As shown in Figure 6, the effects of the compatibilizers and PVC/nylon terpolymer ratio on the impact strength of the blends at -30°C are similar to their effects on the impact strength at room tem-

Table I Notched Izod Impact Strength at Room Temperature of PVC/Nylon Terpolymer Blends with Different PVC/Nylon Terpolymer Ratio^a

Property	Compatibilizer	PVC/Nylon Terpolymer Ratio				
		100/0	75/25	50/50	25/75	0/100
Notched Izod impact strength (J/m) at r.t. ^c	(none)	31	14	22	41	143
	EnBACO	106	19	79	149	777 (nb ^b)
	EnBACO- <i>g</i> -MAH	131	20	1150 (nb)	959 (nb)	901 (nb)

^a PVC/nylon terpolymer: 100 phr; compatibilizer: 14 phr.

^b The specimen was not break after testing.

^c Room temperature.

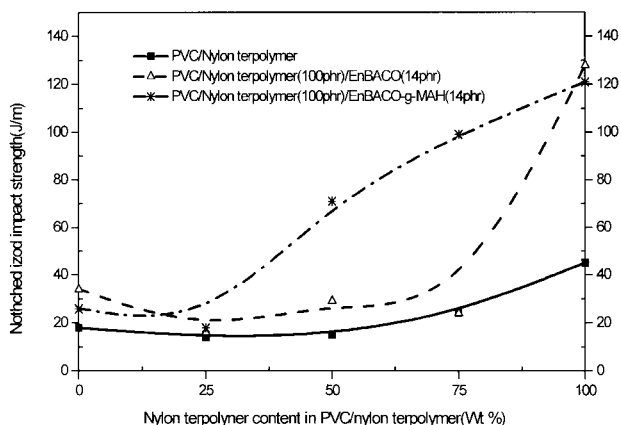


Figure 6 Effects of EnBACO, EnBACO-g-MAH, and nylon terpolymer content on impact strength of the PVC/nylon terpolymer blends at -30°C .

perature as mentioned above. From Table I and Figure 6, it can be seen that the PVC/nylon terpolymer/EnBACO-g-MAH blends at the PVC/nylon terpolymer ratio of 1/1 and 1/3 have very high impact strength at both room temperature and -30°C . The effects of compatibilizer content on the impact strength of the blends at a given PVC/nylon terpolymer ratio of 1/1 are shown in Table II and Figure 7. The toughness of the blend increases with increasing the content of EnBACO-g-MAH. From the experiment data, it can be concluded that EnBACO-g-MAH is more favorable than EnBACO as a compatibilizer for improving the impact strength of PVC/nylon terpolymer blends.

Nylon terpolymer has higher impact strength than PVC, and the nylon terpolymer is a continuous phase in the PVC/nylon terpolymer blends as shown in Figure 1. The impact strength of the PVC/nylon terpolymer blends increases with increasing the nylon terpolymer content. As mentioned above, the PVC domains in the PVC/nylon terpolymer/EnBACO-g-MAH blends at the PVC/nylon terpolymer ratios of 1/1 and 1/3 display

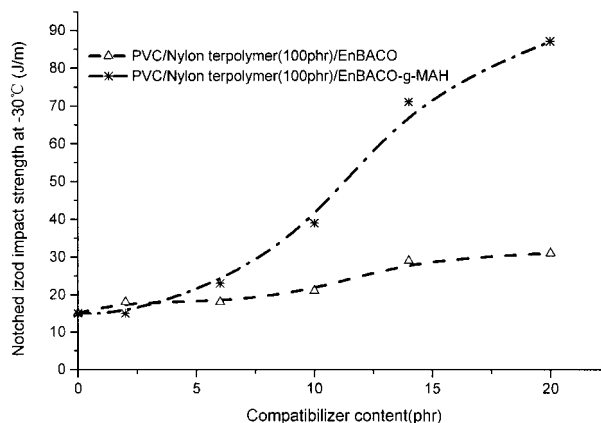


Figure 7 Effects of compatibilizer content on impact strength of the PVC/nylon terpolymer blends at a PVC/nylon terpolymer ratio of 1/1 at -30°C .

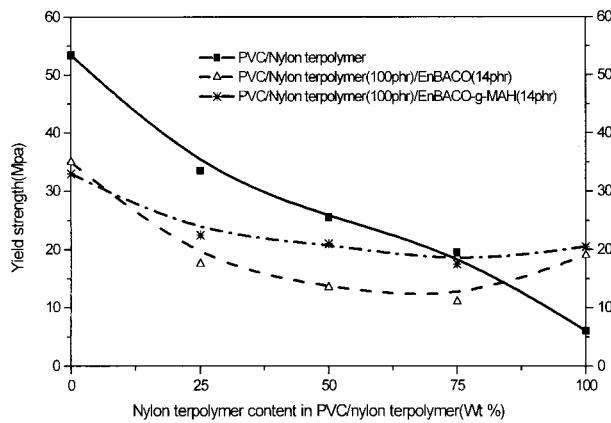
better dispersion than the other blends, which indicates the high compatibilizing efficiency of EnBACO-g-MAH. The good compatibilizing effect may be accounted for as one of the factors for the good toughness of the PVC/nylon terpolymer/EnBACO-g-MAH blends. Figure 6 shows that EnBACO or EnBACO-g-MAH significantly toughens pure nylon terpolymer at a low temperature of -30°C , and makes the impact strength of nylon terpolymer increase from 45 J/m to 128 or 121 J/m, respectively, when 14 phr EnBACO or EnBACO-g-MAH is used. The impact strength of the PVC/nylon terpolymer/EnBACO-g-MAH blends at -30°C at the PVC/nylon terpolymer ratios of 1/1 and 1/3 are much higher than that of the pure nylon terpolymer. A certain amount of EnBACO-g-MAH should have been dispersed in the nylon terpolymer matrix for toughening, which is also one of the factors for the good toughness of PVC/nylon/EnBACO-g-MAH ternary blends.

Yield strength and elongation at break of the blends are shown in Figure 8(a) and (b). With a decreasing PVC/nylon terpolymer ratio from 3/1 to 1/3, the elongation at break increases, and the

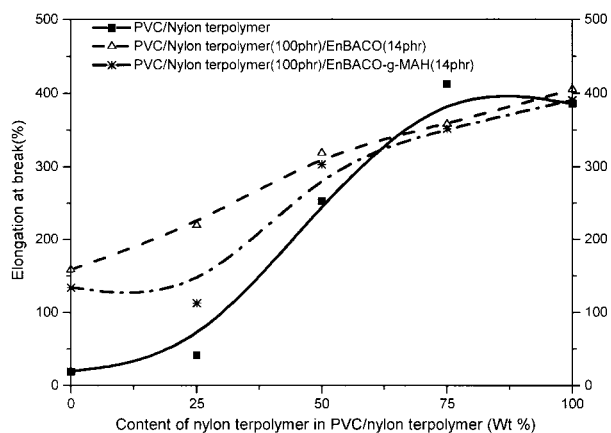
Table II Notched Izod Impact Strength at Room Temperature of PVC (50 phr)/Nylon Terpolymer (50 phr) Blends with Different Compatibilizer Content

Property	Compatibilizer	Content of Compatibilizer (phr)					
		0	2	6	10	14	20
Notched Izod impact strength (J/m) at r.t.	EnBACO	22	34	31	61	79	1046 (nb)
	EnBACO-g-MAH	22	36	74	131	1150 (nb)	1049 (nb)

yield strength decreases. As shown in Figure 8(a), the yield strength decreases in the presence of compatibilizers. The basic reason of decreases of the yield strength is that the compatibilizers have much lower hardness than PVC and the nylon terpolymer. It can be seen from Figure 4 that EnBACO or EnBACO-*g*-MAH have T_g s below room temperature, so the two compatibilizers cause a decrease in yield strength as do elastomers at room temperature. At a PVC/nylon terpolymer ratio of 3/1, the elongation at break of the PVC/nylon terpolymer blends is 41.3%, the elongation at break of the PVC/nylon terpolymer/EnBACO is 219%, and the elongation at break of the PVC/nylon terpolymer/EnBACO-*g*-MAH blend is 113%. These significant differences may be attrib-



(a)



(b)

Figure 8 Effects of EnBACO, EnBACO-*g*-MAH, and nylon terpolymer content on, (a) yield strength, (b) elongation at break of PVC/nylon terpolymer blends.

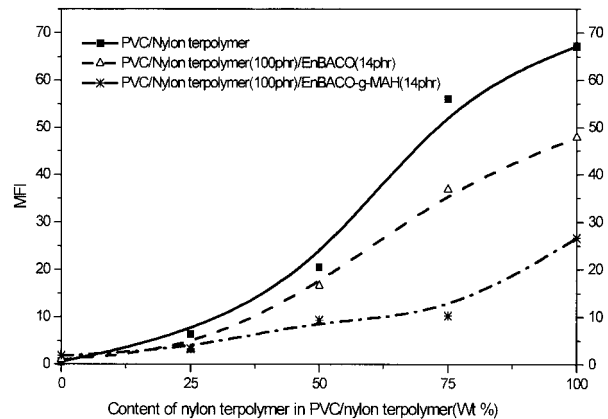


Figure 9 Effects of EnBACO, EnBACO-*g*-MAH, and nylon terpolymer content on MFI PVC/nylon terpolymer blends.

uted to the different compatibilizing effects, as shown in Figure 1(a)–(c).

The MFI of the PVC/nylon terpolymer blends at 190°C under 10 kg is shown in Figure 9. It can be seen that the addition of the nylon terpolymer leads to an increase of MFI due to the high flowability of the nylon terpolymer. An interesting phenomenon is that EnBACO-*g*-MAH has a great effect on the MFI of the PVC/nylon terpolymer blends. The MFI of the PVC/nylon terpolymer/EnBACO-*g*-MAH blends is lower than that of the other blends at the same PVC/nylon terpolymer ratio, whereas the MFI of EnBACO-*g*-MAH (42.4) is even higher than EnBACO (37.8). If there were no chemical reaction, the PVC/nylon terpolymer/EnBACO blends should have much lower MFI than the PVC/nylon terpolymer/EnBACO blends. This hypothesis of no chemical reaction is in conflict with the experiment evidence. Therefore, a chemical reaction occurring in the PVC/nylon terpolymer/EnBACO-*g*-MAH blends is quite possible, which will lead to high viscosity.

As shown in Figure 10, the VST of PVC/nylon terpolymer blends under a low load of 1 kg increases with decreasing the PVC/nylon terpolymer ratios. The presence of two compatibilizers cause decrease in VST, and PVC/nylon terpolymer/EnBACO-*g*-MAH blends have a quicker increase in VST than the other blends with increasing the nylon terpolymer content. The VST of PVC/nylon terpolymer under a 5-kg load is much lower than the VST under a 1-kg load. For example, the VST of the PVC/nylon terpolymer/EnBACO-*g*-MAH (50/50/14) blends under a 5-kg load is 64.1°C, whereas their VST under a 1-kg load is 120°C. The low VST of PVC/nylon terpoly-

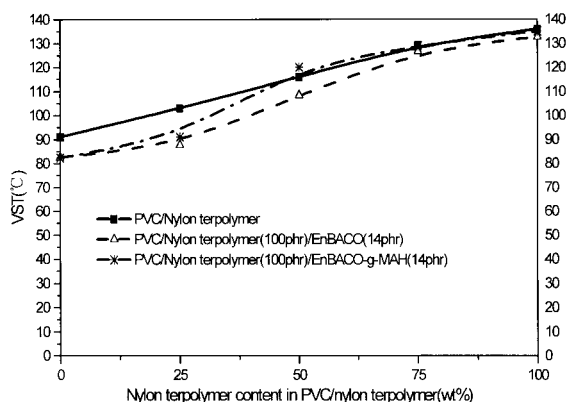


Figure 10 Effects of EnBACO, EnBACO-g-MAH, and nylon terpolymer content on VST of PVC/nylon terpolymer blends.

mer blends under high load can be attributed to the inherent low rigidity of the nylon terpolymer, which is associated with the low crystallinity of the nylon terpolymer.

CONCLUSIONS

The PVC/nylon terpolymer blends developed in this study have a two-phase structure, and the nylon terpolymer is a continuous phase. At the PVC/nylon terpolymer ratio of 3/1, the presence of two compatibilizers, EnBACO and EnBACO-g-MAH, in the PVC/nylon terpolymer blends leads to significantly good dispersion of the PVC domains. The PVC/nylon terpolymer/EnBACO-g-MAH blends have well-dispersed domains of the PVC phase over a broad range of the PVC/nylon terpolymer ratio. The presence of EnBACO or EnBACO-g-MAH in the PVC leads to a broad tan

δ peak and a slight shift to low temperature, and the presence of EnBACO or EnBACO-g-MAH in the nylon terpolymer leads to a shift of the tan δ peak to low temperature.

The impact strength of PVC/nylon terpolymer blends increases with decreasing the PVC/nylon terpolymer ratio from 3/1 to 1/3. EnBACO-g-MAH is more favorable than EnBACO for improving the impact strength of the PVC/nylon terpolymer blends. The PVC/nylon terpolymer/EnBACO-g-MAH blends at the PVC/nylon terpolymer ratios of 1/1 and 1/3 have a good combination of high toughness, high flowability, and high VST. The MFI and VST of all the blends increase with increasing the nylon terpolymer content. The elongation at break and yield strength of the blends depend on the PVC/nylon terpolymer ratios.

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