

Changes in the Interfacial Properties of PC/SAN Blends with Compatibilizer

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Received 9 May 2002; accepted 10 October 2002

ABSTRACT: Block copolymers of polycarbonate-*b*-poly(methyl methacrylate) (PC-*b*-PMMA) and tetramethyl poly(carbonate)-*b*-poly(methyl methacrylate) (TMPC-*b*-PMMA) were examined as compatibilizers for blends of polycarbonate (PC) with styrene-*co*-acrylonitrile (SAN) copolymer. To explore the effects of block copolymers on the compatibility of PC/SAN blends, the average diameter of the dispersed particles in the blend was measured with an image analyzer, and the interfacial properties of the blends were analyzed with an imbedded fiber retraction (IFR) technique and an asymmetric double cantilever beam fracture test. The aver-

age diameter of dispersed particles and interfacial tension of the PC/SAN blends were reduced by adding compatibilizer to the PC/SAN blends. Fracture toughness of the blends was also improved by enhancing interfacial adhesion with compatibilizer. TMPC-*b*-PMMA copolymer was more effective than PC-*b*-PMMA copolymer as a compatibilizer for the PC/SAN blends. © 2003 Wiley Periodicals, Inc. *J Appl Polym Sci* 89: 2649–2656, 2003

Key words: PC/SAN blends; block copolymers; compatibilizer; size of dispersed particles; interfacial properties

INTRODUCTION

Multiphase polymer blends have become commercially important for a variety of applications, such as automobile, home appliance, and electronics. A blend of polycarbonate (PC) (bisphenol-A polycarbonate) with acrylonitrile-butadiene-styrene (ABS) is one of the most successful. A polymer mixture obtained from melt processing always exhibits a separated phase structure when its interaction energy is positive at the processing temperature and pressure.^{1–2}

Generally, small and uniformly dispersed particles are usually advantageous for the properties of polymer blends. ABS materials can be adequately dispersed in PC by conventional extrusion compounding without the use of compatibilization caused by the nearly favorable interactions between PC and styrene-*co*-acrylonitrile (SAN) (acrylonitrile-styrene) matrix.^{3–13} Indeed, uncompatibilized PC/ABS blends are successful commercial materials. However, the application of the PC/ABS blends is often limited because the adhesion strength at the interface is not strong enough.^{14–20} Employment of a proper compatibilizer for improving interfacial adhesion of polymer blends is crucial to broadening the application of the blends.

Compatibilization of a polymer blend is most effectively accomplished by appropriate block or graft co-

polymers that locate at the interface between the phase domains in the blend.^{1,21–25} These copolymers strengthen the interface, reduce the interfacial tension between the phases, and introduce a steric stabilization of the dispersed particles. Reactive compatibilization has been shown to effectively enhance the interfacial properties of polymer blends.^{26–30} Recently, the compatibilization of a PC/ABS blend was examined to extend the commercial applications by improving the interfacial properties of PC with SAN copolymers. A small amount of different commercial polymers such as poly(methyl methacrylate) (PMMA), methacrylate-butadiene-styrene (MBS) copolymer, and styrene-maleic anhydride (SMA) copolymer was added to improve the interfacial adhesion of PC/ABS blend.^{14–15} Wildes et al. examined an amine-functional styrene-acrylonitrile polymer as a reactive compatibilizer.^{18–20} ABS-*g*-MAH (maleic anhydride) copolymers were also examined as a reactive compatibilizer to improve mechanical properties of the PC/ABS blends.^{16–17} Even though various compatibilizers for PC/ABS blend were examined in the previous research, problems in the PC/ABS blend were not resolved completely.

In the current work, to extend the commercial applications of PC/ABS blend by improving the interfacial properties, a new series of block copolymers were prepared to use as the interfacial agents. If the compatibilizer has block segments that are chemically identical to those in the respective phases, then this compatibilizer might work well to improve interfacial adhesion and blend properties.¹ In the previous research,³¹ we found that block copolymer of PC and

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Contract grant sponsor: KOSEF.

TABLE I
Polymers Used in this Study

| Polymers | Copolymer composition (wt %) | Molecular weight | $\overline{M}_w/\overline{M}_n$ | η_f/η_m^a | Sources |
|----------|------------------------------|----------------------------|---------------------------------|-------------------|----------------------------|
| PC | — | $\overline{M}_w = 38,600$ | 1.61 | 1 | Dow Chemical Calibre 300-5 |
| SAN 15 | 14.7% AN | $\overline{M}_w = 182,000$ | 2.19 | 4.103 | Asahi Chemical |
| SAN 20 | 19.7% AN | $\overline{M}_w = 150,200$ | 1.95 | 3.764 | Asahi Chemical |
| SAN 24 | 24.0% AN | $\overline{M}_w = 140,900$ | 1.92 | 3.405 | LG Chemical SAN 80 |
| SAN 28 | 28.0% AN | $\overline{M}_w = 146,600$ | 1.77 | 3.058 | LG Chemical SAN 90 |
| SAN 32 | 32.5% AN | $\overline{M}_w = 170,600$ | 1.84 | 2.876 | LG Chemical SAN 95 |
| SAN 40 | 40% AN | — | — | 3.488 | Jeil Chemical |

^a η_f/η_m is the ratio of zero-shear viscosity of PC to that of SAN copolymer. Note that zero-shear viscosity of PC at 240°C is 6550 Pas.

PMMA (PC-*b*-PMMA) would enhance interfacial interactions between PC and SAN. It also revealed that interfacial interactions were enhanced by increasing molecular weight of PC-*b*-PMMA. PC-*b*-PMMA block copolymer having higher molecular weight than those used in the previous research was prepared to further enhance interfacial interactions. The compatibilizer having chemically nonidentical block segments, which are miscible in the respective phases, might work well to improve interfacial properties.¹ Based on the phase behavior of polymer blends and interaction information of binary pairs observed in previous research, the chemical moiety on one of the block copolymers was varied to attempt to further enhance interfacial interactions.³²⁻⁴¹ Blends of tetramethyl bisphenol-A polycarbonate (TMPC) with PC are miscible, whereas those of TMPC with PMMA are not miscible.³²⁻³⁶ SAN copolymers that are immiscible with PC form miscible blends with PMMA when SAN copolymers contain between 9 and 33 wt % AN.³⁷⁻⁴¹ Based on such interaction information, block copolymer of TMPC and PMMA (TMPC-*b*-PMMA) was also prepared to examine as a compatibilizer of the PC/SAN blend.

MATERIALS AND PROCEDURES

Polymers used in this study are listed in Table I. Some are commercially available, whereas others are experimental materials. PC-*b*-PMMA and TMPC-*b*-PMMA copolymers listed in Table II were specially synthesized for the current work.

The *p*-isopropenyl phenol that contains a vinyl moiety at the chain end was prepared by thermal cracking of bisphenol-A. A mixture containing the required amount of purified bisphenol-A and NaOH was heated in a round-bottomed flask at 250°C for 1 h under the reduced pressure of 2–5 Pa. The *p*-isopropenyl phenol separated from the resulting product was further purified by using *n*-hexane reprecipitation. The *p*-isopropenyl phenol terminated polycarbonates were synthesized by the interfacial polymerization technique. Bisphenol-A (or tetramethyl bisphenol-A) and Na₂S₂O₄ placed in the flask were dissolved in the aqueous solution of NaOH. A solution of *p*-isopropenyl phenol and triphosgene in dichloromethane was added and then reacted at 30°C for 2 h. The reaction was continued for four more hours after adding triethylamine as a phase-transfer catalyst.

Synthesis of the final block copolymer was performed in solution. The vinyl-terminated polycarbonate dissolved in chloroform was reacted at 70°C for 21 h by adding MMA dissolved in toluene and AIBN as the initiator. The precipitated polymer in isopropyl alcohol was vacuum filtered, air dried overnight, and dried in a vacuum oven at 80°C for 24 h. Molecular weights of block segments were determined by GPC by using polystyrene standards. A similar procedure was reported previously.³¹

Blends of PC with SAN copolymer containing various amounts of compatibilizer were prepared by melt mixing. PC, SAN, and compatibilizer were mixed in a torque rheometer (Haake Rheomix) for 15 min at 60

TABLE II
Block Copolymers Synthesized in this Study

| Polymer | Molecular weight of vinyl-terminated PC or TMPC ^a | Molecular weight of block copolymers |
|----------------------|--|--------------------------------------|
| PC- <i>b</i> -PMMA | $\overline{M}_n = 19,100$ | $\overline{M}_n = 69,000$ |
| | $\overline{M}_w = 45,000$ | $\overline{M}_w = 125,000$ |
| TMPC- <i>b</i> -PMMA | $\overline{M}_n = 18,000$ | $\overline{M}_n = 61,500$ |
| | $\overline{M}_w = 42,000$ | $\overline{M}_w = 108,000$ |

^a Molecular weight of block copolymers were determined by GPC using polystyrene standards.

rev/min and 240°C. Blend films of SAN containing various amounts of compatibilizer were prepared by solution casting from dichloromethane in a petri dish. The solvent was allowed to evaporate slowly at room temperature, and the films formed were dried in a vacuum oven at 90°C for 1 week.

The number-average diameter of the dispersed particles in the blend was measured with a digital image analyzer (Bummi Universe Co. I-Top). Specimens prepared by melt mixing were mounted on a hot stage (Linkam THMS 600) equipped with a temperature controller (Linkam TMS 92). The samples were heated rapidly to 240°C and then changes in the size of the dispersed particles were monitored for 1 day. Changes in the average diameter were not observed for that day, so samples were annealed at 240°C for 5 min. The annealed samples were used to measure the average diameter of dispersed particles. The diameters of all particles included in the 10 separate photographs were measured and the mean average was reported as the average diameter of the dispersed particles.

Interfacial tension between PC and SAN, or that between PC and SAN containing various amount of compatibilizer, was measured with an imbedded-fiber retraction (IFR) technique.⁴²⁻⁴⁵ This technique was developed as a dynamic method for measuring the interfacial tension between molten, high molecular weight polymers. The standard equilibrium methods have limitations in measuring interfacial tension between highly viscous polymers due to factors such as a prohibitively long equilibrium time and thermal degradation. The IFR technique involves the microscopic tracking of the shape evolution of a short imbedded fiber and uses interfacial tension as a driving force for the retraction process. As given in eq. (1), the slope of the function-related retracting shape of imbedded fiber, $\lambda [f(R/R_0) - f(R_e/R_0)]$, to the retraction time yields the interfacial tension⁴²⁻⁴⁵:

$$\lambda [f(R/R_0) - f(R_e/R_0)] = t\gamma \quad (1)$$

where R is the effective radius of the retraction fiber, R_e is its value at time $t = 0$, R_0 is the radius of a sphere with a value equal to the volume of the fiber, and γ is interfacial tension. The function $f(R/R_0)$ and λ in eq. (1) were given by

$$f(X) = \frac{3}{2} \ln \left(\frac{\sqrt{1+x+x^2}}{1-x} \right) + \frac{3^{1.5}}{2} \arctan \left(\frac{\sqrt{3}x}{2+x} \right) - \frac{x}{2} - \frac{4}{x^2} \quad (2)$$

$$\lambda = (\eta_m + 1.7\eta_f)R/2.7 \quad (3)$$

where x is equal to R/R_0 or R_e/R_0 , and η_m and η_f are the zero-shear bulk viscosity of the matrix and fiber, respectively.

Fibers of PC were produced with an Instron fiber spinning apparatus. SAN copolymer sheets of 0.15 mm thickness containing various amounts of compatibilizer were prepared by compression molding at 220°C. PC fibers and SAN plates were dried under vacuum at 170 and 110°C, respectively, for 24 h to ensure that no elastic effects related to the fiber orientation occurred. PC fibers were then placed between two plates of SAN copolymer. The samples were subsequently transferred to a microscope equipped with a hot stage and a temperature controller. The samples were annealed at 180°C for 2 h prior to observing the fiber retraction process with an image analyzer at 240°C. The zero shear viscosities (η_0) of PC and SAN copolymer were measured by using a Rheometrics dynamic spectrometer (RDS-II, Rheometrics Inc.) over the shear rate range from 10^{-1} to 10^3 rd^{-1} under a nitrogen atmosphere at 240°C. Values for η_0 obtained from the low-frequency plateau viscosities are listed in Table I.

The interfacial fracture toughness was measured by using an asymmetric double-cantilever beam geometry.⁴⁶⁻⁴⁸ The polymers dried in a vacuum oven at 100°C for 1 day were compression molded into rectangular plates of a dimension of $5.0 \times 1.0 \times 0.2$ cm (length \times width \times thickness) by use of a chrome-plated mold. Films of SAN copolymers containing various amounts of block copolymer were also obtained by solution casting from dichloromethane. The samples were joined together in their respective molds at 190°C for 2 h under slight pressure. The samples were allowed to cool in the mold for 3 h until reaching room temperature, suppressing the formation of the thermal stresses. To examine compatibilization effects of block copolymer, the PC sheet and SAN sheet covered with the thin film of SAN copolymer containing block copolymer were also prepared at the same conditions. Only good samples with no air bubbles at the interface were used to measure the adhesive strength. Because the elastic moduli and crazing stresses in PC and SAN are different, the asymmetric double-cantilever beam test geometry was chosen to avoid crack propagation toward the more compliant material.⁴⁷⁻⁴⁸ If the more compliant material has a lower crazing stress, then crazes will grow at an angle away from the interface. Asymmetry was induced by attaching a SAN rectangular bar having lower crazing stress than the PC rectangular bar to a rigid substrate, in this case a 5-mm glass plate. The specimens were dried in a vacuum oven at 100°C for 1 day before testing. The fracture toughness was measured by inserting a single-edge razorblade at the interface. The wedge was pushed at a constant velocity of 4 $\mu\text{m/s}$ by using a stepping motor. The crack length ahead of the wedge was measured by using an optical microscope after allowing crack propagation for 24 h. Ten values of the crack length were obtained and the mean average was

TABLE III
Summary of Sample Preparation Conditions and Conditions for the Experiments Performed in this Study

| Properties | Sample preparation conditions | Experimental conditions |
|------------------------|---|---|
| Particle size analysis | Melt mixing with torque rheometer, 60 rev/min, 240°C, 15 min | Image analyzer with hot stage; 5 min annealing at 240°C. |
| Interfacial tension | PC fiber: Instron capillary rheometer, 240°C; fiber diameter: 100 μm; fiber length: 2 mm; 180°C, 2 h annealing prior to use. SAN sheet: compression molding at 220°C; dimension: 15 × 15 × 0.15 mm. | Hot stage with microscope; fiber-embedding: 180°C, 2 h; retraction process: 240°C. |
| Fracture toughness | PC, SAN plates: compression molding at 240°C (PC), and 220°C (SAN); dimension: 50 × 10 × 2 mm. SAN with compatibilizer; solvent casting from methylene chloride; sample thickness: 0.15 mm. | Joining condition: 190°C, 2 h under slight pressure; cooling to room temperature for 3 h. Fracture toughness: inserting a single-edge razor blade with a stepping motor (4 μm/s); measurement of crack length ahead of the wedge with microscope. |

used to calculate the fracture toughness. By using the asymmetric double-cantilever geometry, the interfacial fracture toughness, G_c , is given by⁴⁶⁻⁴⁸

$$G_c = \frac{3u^2 E_{PC} D_{PC}^3}{8a^3 [1 + 0.64(D_{PC}/a)]^4} \quad (4)$$

where u is the wedge thickness, a is the crack length, and E_{PC} (=2300 MPa) and D_{PC} are the elastic modulus of PC and thickness of PC rectangular bar. The preparation conditions of samples and the test conditions are summarized in Table III.

RESULTS AND DISCUSSION

Size of the dispersed particles

As reported previously,^{12,31} the average diameter of the dispersed particles as a function of AN content of SAN copolymers at various compositions reached a minimum regardless of blend composition when PC was blended with SAN copolymer containing 24 wt % AN. The average diameter of the dispersed particles in PC/SAN 24, which is varied by changing PC content, was minimized to the value of 1.9 μm at 50 wt % of PC. To reduce the dispersed particle size further by enhancing interfacial adhesion, PC-*b*-PMMA or TMPC-*b*-PMMA copolymer was employed as a compatibilizer for the PC blend with SAN copolymers. The effects of block copolymer content on the dispersed particle size in the PC/SAN 24 blend were examined. In Figure 1, the microstructure of PC/SAN 24 = 8/2 blend was compared with those of PC/SAN 24 = 8/2 blends containing 5 phr PC-*b*-PMMA and TMPC-*b*-PMMA, respectively. The size of the dispersed particles in PC/SAN blend was effectively reduced by adding PC-*b*-PMMA or TMPC-*b*-PMMA copolymer as interfacial agent. As shown in Figure 2, the average diameter of the dispersed particles in PC/SAN 24 (=5/5) was decreased for the blends contain-

ing block copolymer from 0 to about 5.0 phr and then leveled off at a fixed size. A similar trend was observed regardless of blend composition and AN con-

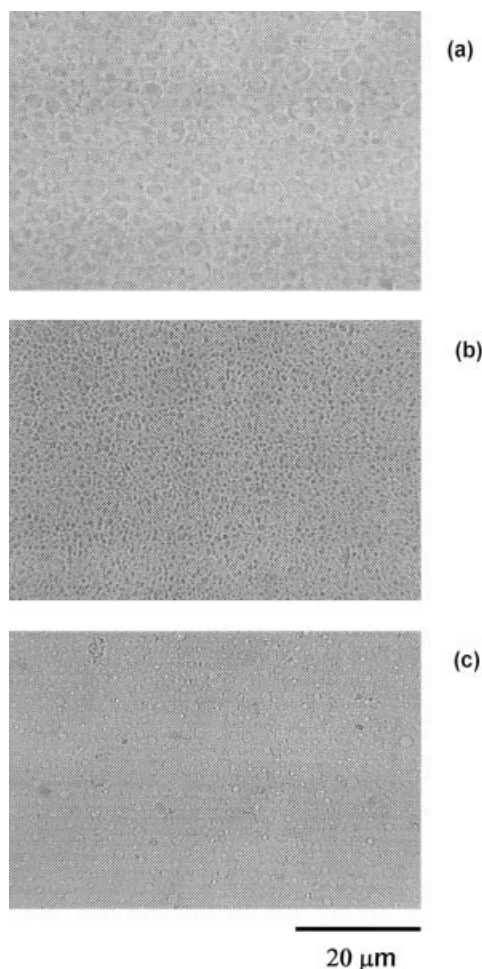


Figure 1 Microphotographs of PC/SAN 24 = 8/2 blend observed with an image analyzer; (a) without compatibilizer; (b) with 5 phr PC-*b*-PMMA; (c) with 5 phr TMPC-*b*-PMMA.

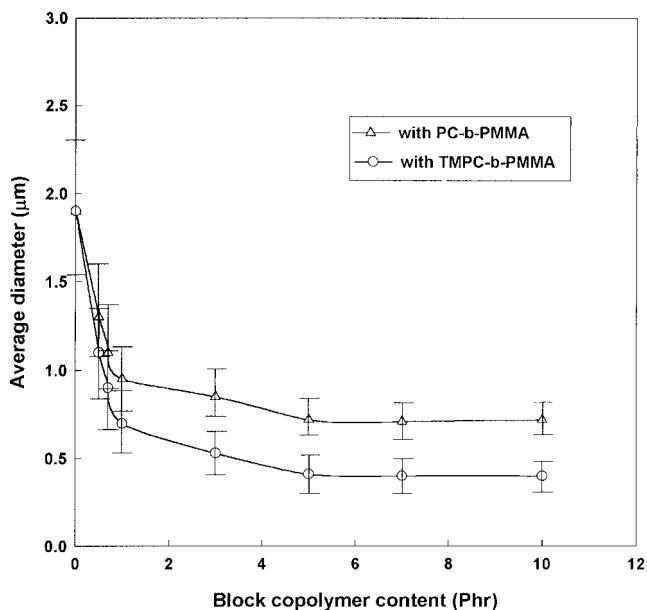


Figure 2 The average diameter of the dispersed particles (\pm standard deviations of the particle size distribution) for the PC/SAN 24 = 5/5 blends as a function of block copolymer content.

tent of SAN copolymers. Because of this, the average domain sizes reported hereafter are those for the blends containing 5 phr block copolymer.

Figure 3 shows the average diameter of PC/SAN = 5/5 blends with or without compatibilizer as a function of AN content of SAN copolymers. Note that two block copolymer compatibilizers have similar block sizes so the only difference is the chemical moiety, and PC-*b*-PMMA used here has a much higher molecular weight than those used previously.³¹ The average diameter of the dispersed particles reached a minimum when PC was blended with SAN 24 copolymer. The error bars in Figure 3 represent the standard deviations of the particle size distribution. Note that the standard deviation of the average diameter calculated from the each photo is smaller than 0.1 μm . The average diameter was reduced by adding compatibilizer regardless of AN content of SAN copolymers. Particularly, the average diameter of the dispersed particles in the PC/SAN 24 = 5/5 blends was reduced from 1.9 to 0.7 μm by adding PC-*b*-PMMA copolymer and that was further reduced down to 0.4 μm by adding TMPC-*b*-PMMA copolymer. The high molecular weight compatibilizers enhance interfacial interactions between two phases as compared to the much lower molecular weight compatibilizers used previously.³¹ The average diameter of the PC/SAN blends compatibilized with TMPC-*b*-PMMA is smaller than that of the PC/SAN blends compatibilized with PC-*b*-PMMA, as shown in Figure 3. The error bars of PC/SAN = 5/5 blends with or without compatibilizer suggest that compatibilizer produces a narrower particle size distribution.

Interfacial characteristics of PC/SAN blends

The interfacial tension is an important factor in determining the morphology of the immiscible blend. To explore the effects of compatibilizer on the interfacial tension of PC/SAN blend, the changes in the interfacial tension of PC/SAN blends containing various amounts of compatibilizer were examined with IFR technique. As predicted in eq. (1), the experimental data shown in Figure 4 did yield a straight line. Figure 5 shows the interfacial tension, γ , between PC and various SAN copolymers as a function of AN content. A minimum value in the interfacial tension was observed at around 24 wt % AN. The changes in the values of the interfacial tension are also consistent with the experimental results related to the average diameter of the dispersed particles. To explore the effect of the addition of the PC-*b*-PMMA or TMPC-*b*-PMMA copolymer on the compatibility of the PC/SAN blends, SAN matrices containing various amounts of block copolymer were prepared. The changes in the interfacial tension of PC/SAN 24 blend as a function of the block copolymer content are given in Figure 6. The interfacial tension decreased very rapidly for block copolymer content ranging from 0 to 10 wt % (note that this value approximately corresponds to 5 phr block copolymer in blend) and then leveled off to a saturation value. As shown in Figure 5, interfacial tension of PC blends with SAN matrix containing 10 wt % block copolymer was reduced regardless of AN content of SAN copolymers. TMPC-*b*-PMMA copolymer was more effective than PC-*b*-PMMA copolymer in reducing interfacial tension.

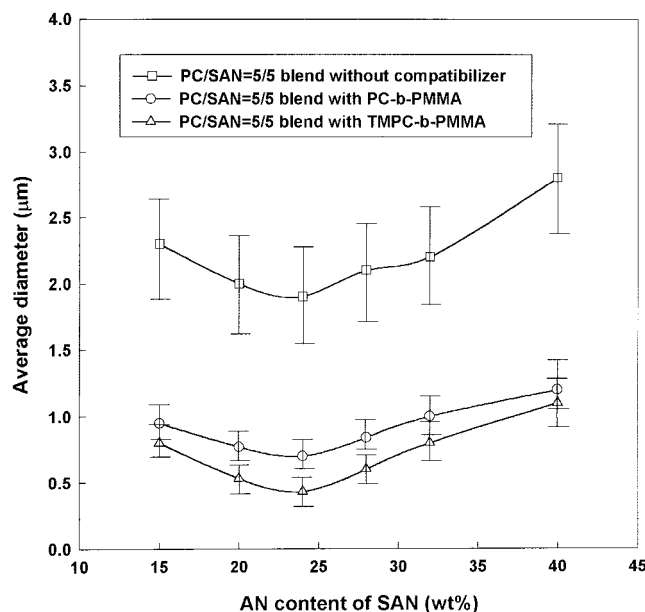


Figure 3 The average diameter of the dispersed particles (\pm standard deviation of the particle size distribution) for the PC/SAN = 5/5 blends as a function of AN content of SAN copolymer.

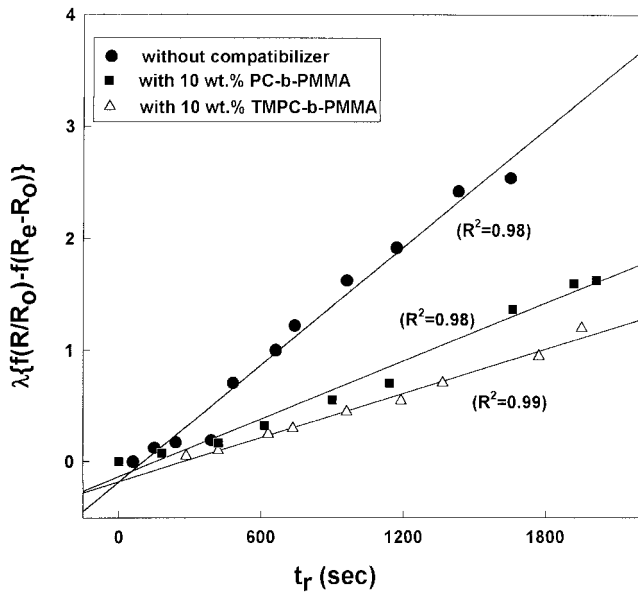


Figure 4 Plot of the function $\lambda [f(R/R_0) - f(R_e/R_0)]$ versus the retraction time for a PC fiber.

Interfacial adhesion

The adhesion energy,⁴⁶⁻⁴⁸ G_c , between PC and SAN copolymer without block copolymer is given in Figure 7 as a function of AN content in SAN copolymers. A maximum in the adhesion energy at around 24 wt % AN was observed. The highest fracture toughness of PC/SAN 24 blend is due to maximum interfacial adhesion resulting from the lowest interaction energy value. The changes in the fracture toughness were examined by varying block copolymer content of SAN

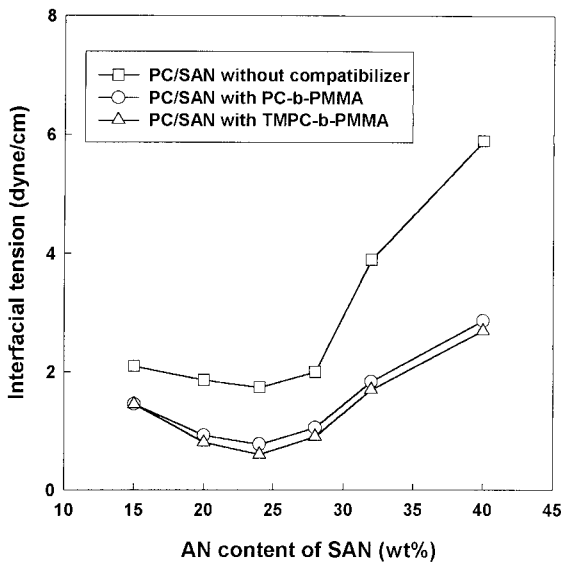


Figure 5 Interfacial tensions between PC and SAN copolymer as a function AN content of SAN copolymers. Note that the deviation of the $R^2 = 1$ value in the curve fits in Figure 4 was smaller than 0.02.

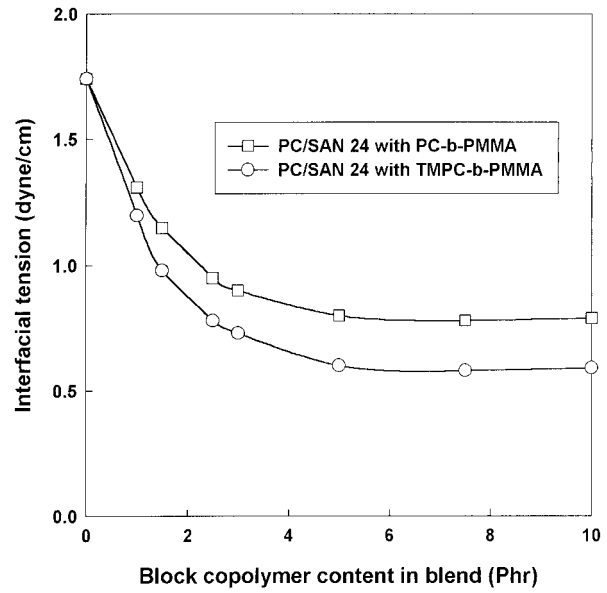


Figure 6 Effects of compatibilizer content on the interfacial tension between PC and SAN 24 copolymer. Note that the deviation of the $R^2 = 1$ value in the curve fits in Figure 4 was smaller than 0.02.

24 film, which was placed between a PC and SAN sheet and compression molded. The increase in the fracture toughness of PC/SAN 24 blend was observed by increasing block copolymer content and then approached an asymptotic value as shown in Figure 8. Fracture toughness of PC/SAN blends examined with SAN film containing 10 wt % block copolymer was increased regardless of AN content of SAN copoly-

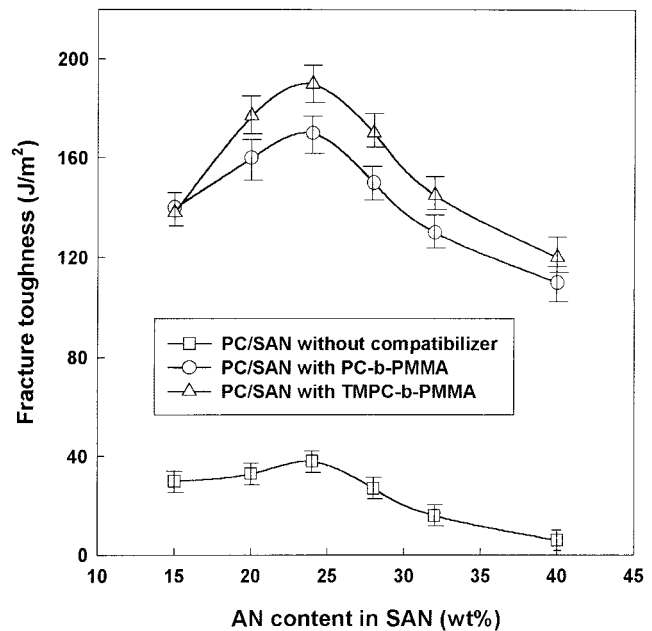


Figure 7 Fracture toughness (\pm standard deviation of the fracture toughness) for PC/SAN adhesive joint as a function AN content of SAN copolymers.

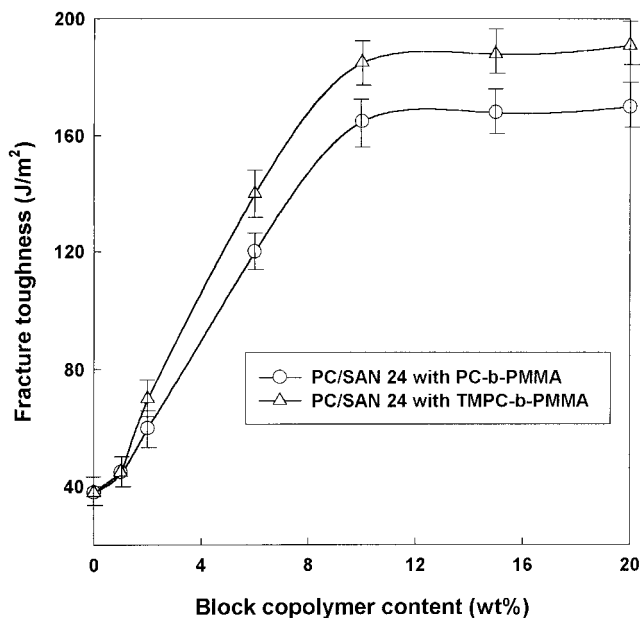


Figure 8 Fracture toughness (\pm standard deviation of the fracture toughness) for PC/SAN adhesive joint containing various amount of block copolymer.

mers. TMPC-*b*-PMMA copolymer was also more effective than PC-*b*-PMMA copolymer in increasing fracture toughness as shown in Figures 7 and 8. When PC/SAN blends containing more than certain amounts of block copolymer, the size of dispersed particles, interfacial tension, and fracture toughness have asymptotic value. It might come from the formation of the micelles by itself in either of the polymer phases instead of existing at the interface.

The results related to the changes in the average diameter of dispersed particles, interfacial tension, and the interfacial fracture toughness indicate that TMPC-*b*-PMMA copolymer is more effective than PC-*b*-PMMA copolymer as compatibilizer for PC/SAN blends. PC or TMPC segment in the block copolymer that exists at the interface might stretch to the PC rich-phase because PC blends with TMPC are miscible and the interaction energy density between them is negative (-0.25 cal/cm^3).³²⁻³⁶ It is well known that the window of miscibility for PMMA with SAN copolymers extends from 9.5 to 32.5 wt % AN.³⁷⁻⁴¹ Through numerous studies,⁴⁹⁻⁵³ it has been proven that PC/PMMA blends appeared to be right on the edge of miscibility. The blend is either miscible or immiscible, depending on the molecular weight of components that were blended. The blend for commercial molecular weights of both components is immiscible at equilibrium, whereas miscible blends were found for the blend of PC and PMMA, at which the molecular weight of either component was lower than a certain value.⁵²⁻⁵³ PC-*b*-PMMA copolymer synthesized in our laboratory had a single T_g and the film was transpar-

ent. Stretching the PMMA segment in PC-*b*-PMMA copolymer to the SAN-rich phase might be somewhat restricted because of relative favorable interactions between PC and PMMA. Note that the reported interaction energy density between PC and PMMA is 0.03 cal/cm^3 .⁵³ However, TMPC blend with PMMA is completely immiscible and its reported interaction energy density (0.25 cal/cm^3) is larger than that between PC and PMMA.³³ The stretching of the PMMA segment in TMPC-*b*-PMMA to the SAN-rich phase could have occurred easily because of the relatively strong intramolecular repulsion between TMPC and PMMA segments. The fact that TMPC-*b*-PMMA is more effective than PC-*b*-PMMA as compatibilizer of PC/SAN blends might come from the difference in the interactions between segments in the block copolymer.

CONCLUSIONS

Block copolymers (i.e., PC-*b*-PMMA and TMPC-*b*-SAN) were examined as compatibilizers for PC/SAN blends. They were produced from MMA monomer and the vinyl-terminated polycarbonate prepared by interfacially reacting bisphenol-A (or tetramethyl bisphenol-A) with triphosgene and *p*-isopropenyl phenol. The number-average diameter of the dispersed particles and their interfacial properties were explored. The average diameter of the dispersed particles and interfacial tension were further reduced by adding block copolymer to the PC/SAN blends. Furthermore, fracture toughness of PC/SAN blend was also improved by adding block copolymer as compatibilizer. The TMPC-*b*-PMMA copolymer was more effective than PC-*b*-PMMA copolymer as compatibilizer for PC/SAN blend. The results observed here suggest that the commercial applications of PC/ABS blends can be broadened by improving the interfacial properties between PC and SAN with proper compatibilizer.

This study was supported by research grants from the Korea Science and Engineering Foundation (KOSEF) through the Applied Rheology Center (ARC), an official KOSEF-created engineering research center (ERC) at Korea University, Seoul, Korea. C. K. Kim also thanks Chung-Ang University for equipment grants.

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