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Compatibility characterization of polycarbonate/copolyester blends

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Abstract

The compatibility behaviour of melt-mixed blends of an amorphous copolyester poly(ethylene-*co*-cycloexane 1,4-dimethanol terephthalate) (PETG), with bisphenol-A polycarbonate (PC) was investigated over the complete composition range. The techniques applied were dynamic mechanical analysis (DMA), tensile testing, optical and electron microscopy and FT-IR spectroscopy. DMA data indicated a nearly miscible polymeric alloy and these results are in line with the tensile properties obtained and the morphology examination of films and cryo-fractured surfaces. Analysis of the shifts of the main viscoelastic transitions (caused by the partial component mixing), using available theory, allowed the determination of the χ_{12} polymer–polymer interaction parameter and its critical value χ_c characterizing the phase stability of the blend. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Polycarbonate/polyester blends; Partial blend miscibility; Polymer–polymer interaction parameter

1. Introduction

In previous work we have reported on the compatibility behaviour of melt-mixed blends of poly(ethylene-*co*-cyclohexane 1,4-dimethanol terephthalate) (PETG), an amorphous copolyester, with crystalline aromatic polyesters; poly(butylene terephthalate) (PBT) [1] and poly(ethylene terephthalate) (PET) [2]. In both cases miscibility was attained in the amorphous phase.

In this study the phase behaviour and solid state properties characterizing the compatibility of bisphenol-A polycarbonate (PC)/PETG are reported. PC is increasingly used as a homopolymer or in blends since it combines clarity with toughness and rigidity. Blending with PETG—a copolyester with optical clarity, good low temperature toughness, lower T_g and resistance to hydrocarbons—may enhance PC ductility and its resistance to solvent stress cracking. Moreover these studies involving amorphous polymers may contribute towards the development of predictive blend miscibility schemes free from the complicating interference of the crystallization process.

Most of PC/polyester blends studied up to ca. 1997 are quoted in Ref. [3] where a phase behaviour predictive scheme based on a binary interaction model developed along the lines of copolymer–copolymer miscibility theory [4] is applied for these blends.

A literature survey covering the 1997–1998 period produced about 200 papers on PC blends, patents excluded. An earlier report [5] of some relevance to the present system, examined the T_g and the free volume changes on mixing of blends of PC/copolyester of 1,4-cyclohexane dimethanol with iso- and terephthalic acids. T_g data indicated non-specific intermolecular interactions leading to miscibility in the complete composition range and positron annihilation spectroscopy reported in a related work indicated a free volume contraction on mixing—characteristic of attractive intermolecular interactions. The same blend had also been studied before and on the basis of dynamic mechanical analysis (DMA) was reported to be miscible in the amorphous phase [6,7].

The rest of these PC blends (v.a.) in the order of decreasing frequency refer to PC/polyester liquid crystals (PLC), PC/epoxies and PC/polyester homopolymers (PBT, PET, PMMA). In the following typical studies will be quoted. In the case of PC/PLC, the copolyester or copolyesteramide structure of the LC is usefully exploited to obtain partially miscible blends via ester exchange reactions [8,9]. Properties examined were morphology development, mutual wetting [10] and mechanical properties [11,12]. Interest in these polymeric alloys stems from improved mechanical properties provided by the PC matrix and rheological features that make them suitable for the production of low cost, thin-wall, low-warpage plastic components [13].

Transesterification reactions are also responsible for the compatibilization of PC/epoxy blends. These take place

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Table 1
Ultimate tensile properties of blends

PETG/PC	Mixing temperature (°C)	Mixing time (min)	σ_y (MPa)	σ_b (MPa)	ε_b (%) $\Delta L/L_0$	E_b (J cm^{-3})
100/0	270	10	34 ± 2	41 ± 5	491 ± 38	128 ± 11
85/15	270	10	37 ± 2	42 ± 3	299 ± 33	93 ± 7
67/33	270	10	31 ± 4	38 ± 6	234 ± 21	79 ± 4
67/33[a]	270	10	41 ± 2	48 ± 6	247 ± 12	96 ± 2
67/33	270	5	32 ± 6	35 ± 3	242 ± 24	64 ± 7
67/33	270	20	33 ± 3	37 ± 5	245 ± 33	71 ± 9
50/50	270	10	33 ± 2	43 ± 3	210 ± 4	68 ± 1
33/67	270	10	35 ± 0	38 ± 3	189 ± 11	62 ± 4
15/85	270	10	48 ± 2	50 ± 2	167 ± 12	75 ± 4
0/100	270	10	46 ± 3	56 ± 3	153 ± 28	68 ± 8

[a] After 5.5 months physical ageing.

primarily between the carbonate group of PC and the hydroxyls obtained by opening of the oxirane moiety of the epoxy after the addition of a catalyst (amine) [14,15]. The technological interest in these polymeric alloys lies in that the PC may, in principle, increase the toughness of the epoxy component.

Numerous studies have also been devoted to PC/PBT and PC/amide modified PBT blends. These aimed at elucidating the exchange reactions during melt mixing [16,17] and its effect on phase separation, morphology [18,19] and crystallization [19]. The effect of the MW of the PC on the phase structure has also been examined [20]. Exchange reactions leading to copolymer formation were also studied for PC/PMMA [21] and PC/PET [22] blends. An interesting one-step extrusion process in the presence of a catalyst was shown to compatibilize PC/PET and may produce PC-*b*-PET copolymers by a suitable control of the mixing procedure [23].

In the case of ternary blends a judicial application of PC/polyester blend may lead to a compatible ternary system. Thus PMMA may compatibilize the incompatible PC/Poly(vinylidene fluoride) [24] or the PC/ABS blend [25]. The latter has also been compatibilized using alkyl-modified poly(ε-caprolactone) [26].

In the present study the compatibility of melt-mixed blends of PC/PETG in the complete composition range was characterized using mainly, tensile testing, DMA, optical (phase contrast) and electronic microscopy (SEM).

2. Experimental

2.1. Materials and specimen preparation

PETG-6763 was obtained from Tennessee Eastman Co., with $\bar{M}_n = 26\,000$. It was reported [6] to consist of cyclohexane dimethanol, ethylene glycol and terephthalic acid in a molar ratio of approximately 1/2/3. Bisphenol-A PC was obtained from BDH Chemicals Ltd, with $\bar{M}_n = 29\,000$. They were both dried overnight at 80°C in dynamic vacuum. Blends were prepared by melt mixing at 270°C in a home-made stainless steel bob-and-cup type of mixer previously described [27]. This temperature ensured adequate fluidity for the mixing and stability against thermal degradation. Preliminary stability experiments using thermogravimetric analysis (TGA) showed component weight loss above 300°C. The mixing cup was blanketed under an argon atmosphere. Based on tensile properties, specifically the ultimate elongation ε_b, optimum mixing time determined was 10 min.

Compositions of PETG/PC blend prepared were; 85/15, 67/33, 50/50, 33/67, 15/85. Films were obtained by compression moulding between Teflon sheets at 270°C and 10 MPa for 1.0 min, followed by pressure release and quenching to 0°C.

2.2. Apparatus and procedures

Tensile tests were performed at a crosshead speed of 10 cm min^{-1} and at 23°C, according to ASTM D882 using a J J Tensile Tester type 5001 and rectangular strips measuring $6.0 \times 0.65 \times 0.25$ cm^3.

DMA data storage modulus E', loss modulus E'' and loss angle tan δ were obtained at 10 Hz with the RSA II dynamic mechanical spectrometer of Rheometric Scientific Ltd. Specimen dimensions were $2.3 \times 0.5 \times 0.015$ cm^3.

TGA scans were performed at 10°C min^{-1} using a Du Pont 951 thermogravimetric analyser equipped with a 990 programmer recorder. Nominal weight of samples was 10 mg.

FTIR spectra were obtained using a Perkin–Elmer 1600 spectrometer.

Optical micrographs with phase contrast arrangement were obtained with a Olympus BH-2 microscope.

SEM was carried out with a JEOL JSM 6300 instrument at a tilt angle of 30° and a working distance 16–18 mm on specimens fractured at cryogenic temperature.

3. Results

3.1. Tensile properties

Results on the ultimate properties are summarized in

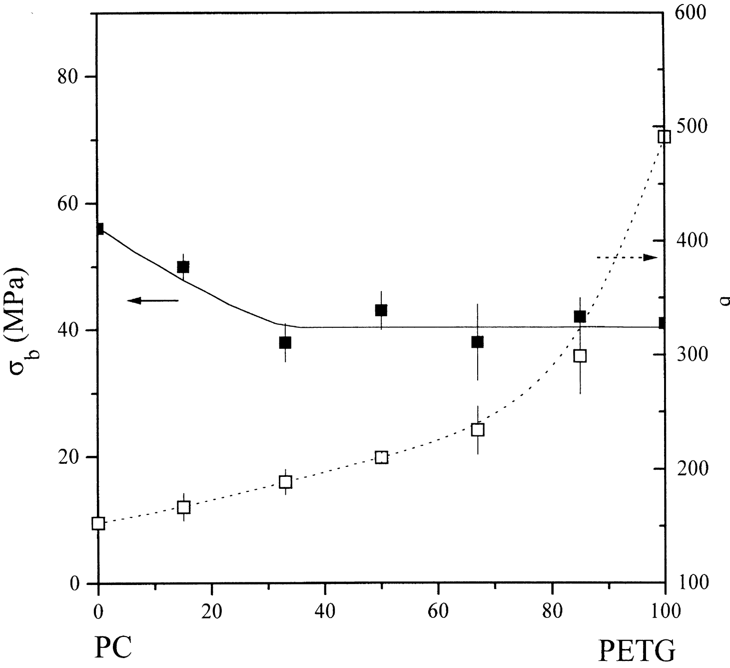


Fig. 1. Composition dependence of tensile strength (σ_b) and tensile elongation (ε_b) of PETG/PC blends: (■) σ_b; (□) ε_b.

Table 1 for blends quenched to 0°C and conditioned for 24 h at 25°C and 60% R.H. Quantities of interest are yield stress σ_y, strength σ_b, ultimate elongation ε_b% and energy to tensile failure E_b. The composition dependence of σ_b, ε_b% and E_b is also shown in Figs. 1 and 2, respectively. Results on ε_b, (a sensitive indicator of component adhesion in blends), show a smooth transition from PC to PETG with a small negative deviation from the arithmetic weight average, see also Fig. 1. A similar trend is also shown by σ_b. Addition of ca. 33 wt% PETG to PC reduces the σ_b of the latter by about the same percentage and stabilizes blends' strength to that of the copolyester. Overall ultimate tensile properties are good and the E_b of PC, a tough polymer, is further increased at increased amounts of PETG; see also Fig. 2.

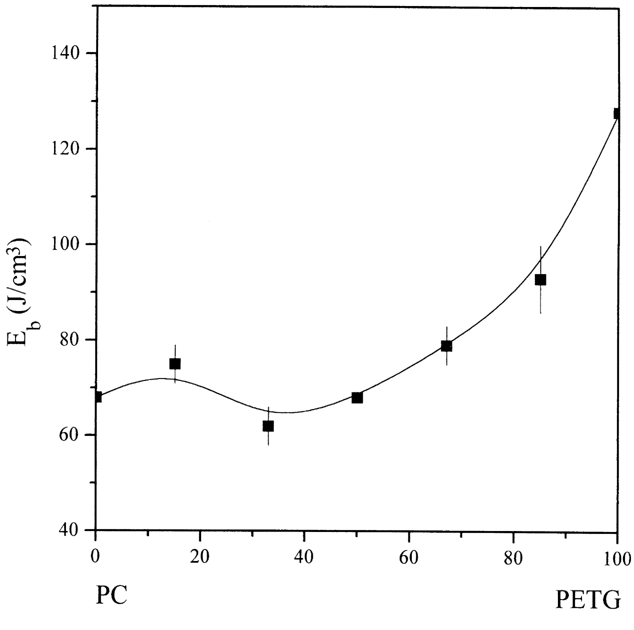


Fig. 2. Composition dependence of energy to tensile failure E_b of PETG/PC blends.

Table 1 gives data on the effect of mixing time (t_m) and ageing at one composition. Already at $t_m = 5$ min tensile properties are stabilized while no effects due to ageing are observed. This densification process [28] is usually accompanied by an increase of σ_b and a decrease in ductility.

3.2. Dynamic mechanical analysis

Main relaxations (T_g) of blends are reported in Table 2. Figs. 3 and 4 give the DMA spectra at isochronous condition of the storage E' and loss modulus E'' of blends, respectively. The spectra are typical of a phase separated polymer alloy with significant mutual convergence of the main T_gs; that of PC from 156 to ca. 110°C for the 85/15, see Table 2, and of PETG from 85 to 95°C for the 15/85 PETG/PC blend.

Table 2 also gives data on the effect of mixing time on the T_g convergence. An increase of t_m from 5 to 20 min causes a noticeable increase of shift, especially for PC (T_g reduction). A smaller $T_{g,PC}$ reduction is also caused by heat treatment of the 33/67 blend. These results suggest either an improvement in the degree of components' dispersion with t_m and/or the occurrence of interchange reactions to a limited extent in the melt. These findings are discussed below.

Table 2 also shows that increased mixing time has no effect on the T_g of PC itself.

Table 2
Main viscoelastic relaxations of PETG/PC blends

PETG/PC	T_g (×°C)	
	PETG	PC
100/0	85.0	–
85/15	88.5	110[a]
67/33	93.8	132.9
67/33[b]	90.9	140.2
67/33[c]	94.7	121.3
50/50	94.5	130.3
33/67	92.8	136.4
33/67[d]	91.2	133.4
15/85	94.9	140.9
0/100	–	156.1
0/100[c]	–	156.0

[a] Shoulder.
[b] Mixing time 5 min.
[c] Mixing time 20 min.
[d] After annealing at 150°C for 1 h.

3.3. Morphology

Given the refractive indices of PETG ($n_D = 1.510$) [1] and PC ($n_D = 1.585$) [29], one would expect a separate-domains morphology for these blends. Phase-contrast micrographs of quenched blends at three equally-spaced compositions failed to reveal such a morphology.

SEM micrographs of cryofractured surfaces are given in Fig. 5. At the 67/33 PETG/PC composition, increasing t_m from 5 (Fig. 5a and b) to 10 (Fig. 5c) or 20 min (Fig. 5d), markedly improved the degree of dispersion. Comparison of micrographs 5a,b with 5c,d indicates that a 10 min mixing time is adequate, the latter product having a mixed ductile–glassy fracture surface which is typical of a homogeneous solid. At increased PC/PETG ratio, Fig. 5e, the fracture surface is similar in character however there is evidence of the wetting and subsequently debonded minor component from the PC surface onto which it had been attached.

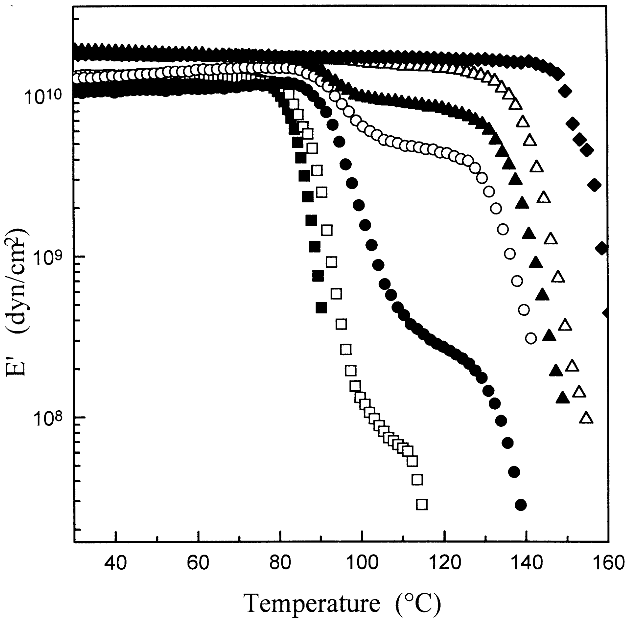


Fig. 3. Temperature dependence of storage modulus of PETG/PC blends: (■) 100/0; (□) 85/15; (●) 67/33; (○) 50/50; (▲) 33/67; (△) 15/85; (◆) 0/100.

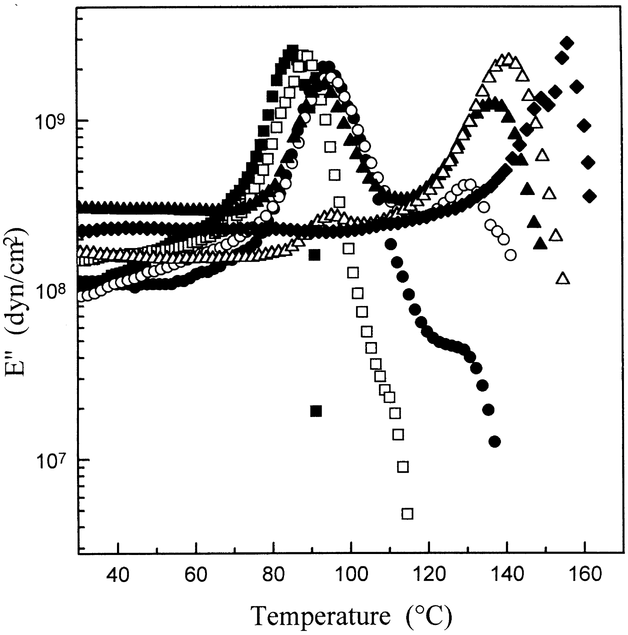


Fig. 4. Temperature dependence of loss modulus of PETG/PC blends: (■) 100/0; (□) 85/15; (●) 67/33; (○) 50/50; (▲) 33/67; (△) 15/85; (◆) 0/100.

4. Discussion

The results from tensile testing suggest compatible blends and their composition dependence the absence of synergism—very often the result of strong intermolecular forces [30].

DMA results support the view of a partially miscible blend at the temperature regime where this method was applied. This is supported by the considerable components' T_g convergence in the blend, in particular that of PC. The possibility for ester interchange reactions should not be excluded in view of the effect of mixing time (t_m) and annealing on the T_g shift (v.a.). There are numerous reports on such interchange reactions among polyesters during melt mixing [31]. However in relevant literature on related PC blends the t_m employed is longer (higher than 20 min) and often a transesterification catalyst is employed. In the case of PC/polyarylate (PAr) blends transesterification was reported [32] to take place without a catalyst. A blend that bears similarity to our system is the PETG/PAr blend [33]. A single T_g of blend (T_{gB}) was reported and the miscibility did not depend on transesterification. Also blends with up to 30 wt% PAr showed appreciable transesterification [34]. Since PETG contains PET units it is of relevance to note

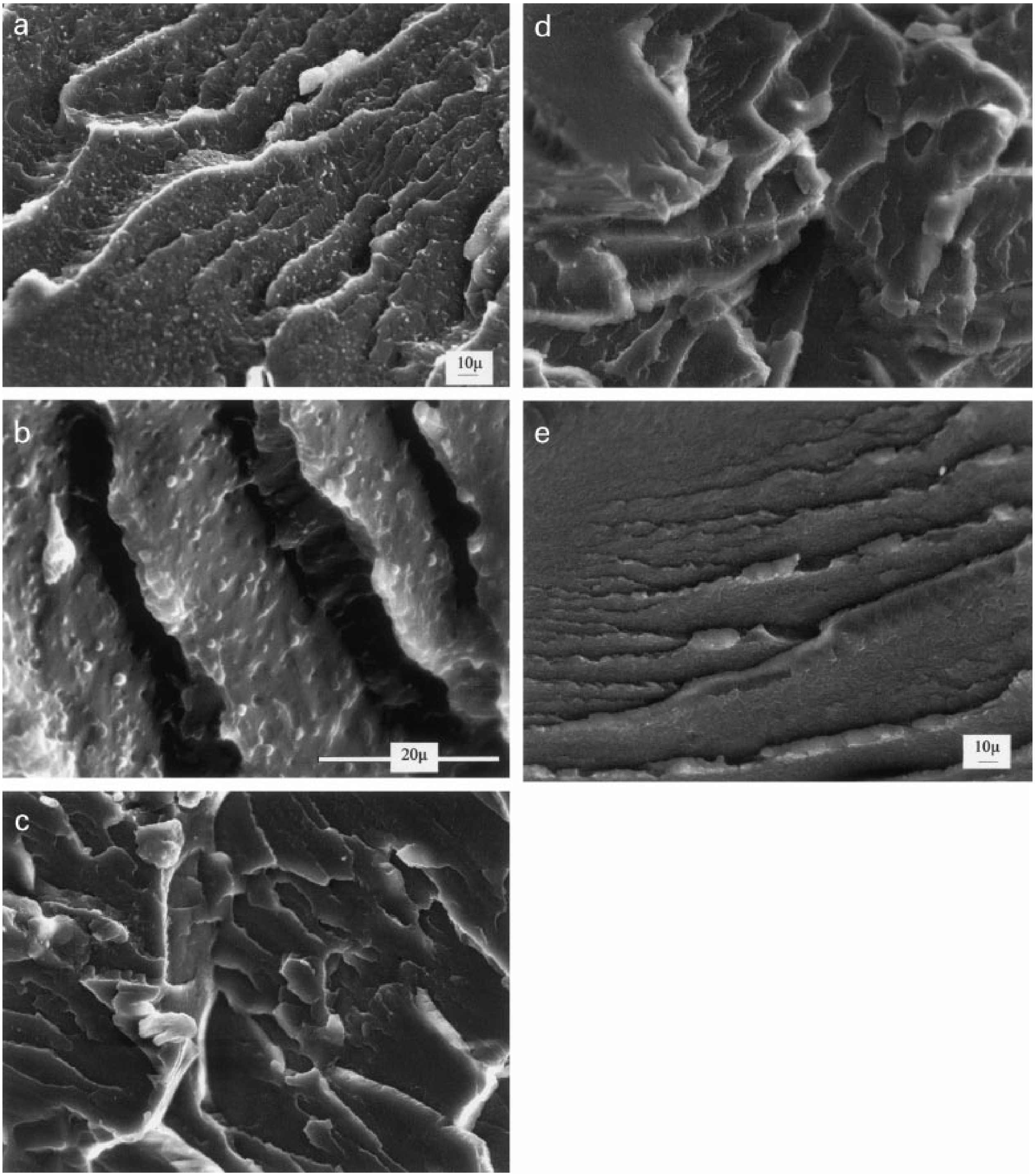
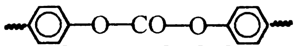
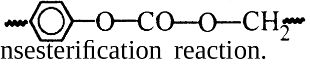


Fig. 5. SEM micrographs of cryo-fractured PETG/PC blends: (a) 67/33 $t_m = 5$ min; (b) 67/33 $t_m = 5$ min (higher magnification); (c) 67/33 $t_m = 10$ min; (d) 67/33 $t_m = 20$ min; (e) 33/67 $t_m = 10$ min.

that blends of PC/PET with >60–70 wt% PET are miscible and very little, if any, interchange reactions take place between the carbonate and ester groups during melt mixing [35,36].

In Fig. 6 an examination of FT-IR spectra of one blend at various t_m (5–20 min) does not reveal any increase of the 1770/1780 cm^{-1} ratio reported to be affected by the transesterification process of PC/PBT blends [37]. The 1780 cm^{-1} absorption corresponds to the aromatic carbonate group  and the 1770 cm^{-1} absorption to the mixed aliphatic–aromatic carbonate moiety  that may form during the transesterification reaction.

An alternative explanation on the T_g shift observed, supported by the SEM findings, would attribute it to the improvement of dispersion with increasing t_m of a microphase separated blend; compare Fig. 5a and b with c.

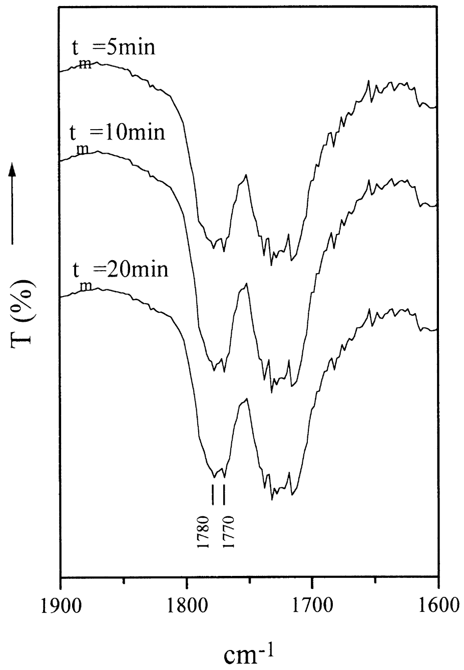
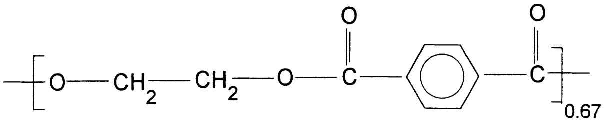


Fig. 6. FT-IR spectra of PETG/PC 67/33 blend at various mixing times.

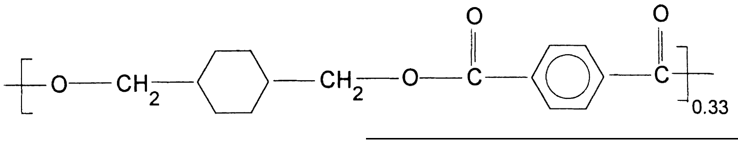
To rationalize these results the copolymer–copolymer miscibility theory [38] was applied which takes into account inter- as well as intramolecular forces and may give an estimate of the polymer–polymer interaction parameter χ_{12}. For a binary blend of a homopolymer A_n with a random copolymer $(C_yD_{y-1})_m$ both of high MW, miscibility is predicted depending on the sign of χ_{12} given in the present case by

$$\chi_{12} = y\chi_{AC} + (1-y)\chi_{AD} - y(1-y)\chi_{CD} \tag{1}$$

where y is the copolymer composition in volume fraction and χ_{ij} the segmental interaction parameter between structural units i and j. Miscibility is predicted for copolymer compositions where $\chi_{12} \leq 0$. For this work A is identified as the PC repeat unit and C_yD_{y-1} as [1],



and



respectively.

The segmental interaction parameter χ_{ij} may be determined according to Krause's scheme [39] using Eq. (2) and the solubility parameter values δ by the application of Eq. (3),

$$\chi_{ij} = \frac{V_r}{RT}(\delta_i - \delta_j)^2 \tag{2}$$

$$\delta = \rho\frac{\sum F_i}{M} \tag{3}$$

where V_r is a reference volume (the smallest molar volume among blend components), ρ is the polymer density, F_i the molar attraction constant of group i and M the MW of the structural unit. For the copolymer δ was calculated taking into account its composition [39]. Calculation of χ_{ij} using this procedure assumes the absence of strong specific forces. The results of such a calculation are given in Fig. 7 in terms of the temperature dependence of χ_{12}. At the mixing temperature employed (270°C) $\chi_{12} = 0.056$, a value unfavourable to mixing. Calculation of δ hence χ_{ij} at different temperatures was made by combining Eq. (2) with the expression $\partial \ln \delta/\partial T = -\alpha$, [40] where α is the coefficient of cubic expansion.

A different approach to determine χ_{12} was also followed based on the T_g shifts observed. This has been done before for immiscible blends [41,42] and the methodology adopted was that applied by Yang and Yetter [43] to characterize the miscibility of a low and a high MW PC with a high-T_g polyester. This approach leads to the free energy of mixing ΔG_m and the determination of whether the condition for blend stability at the spinodal is satisfied. The relevant theory rests on that of the Flory–Huggins for solutions [44] as applied to polymer blends by Sanchez [45]. In the following only basic equations will be given necessary to analyse our results. More details may be found in Ref. [43].

The free energy of mixing per unit volume is formally expressed as

$$\Delta G_m = \frac{1}{V}(\Delta H_m - T\Delta S_m) \tag{4}$$

where V, ΔH_m and ΔS_m are, respectively, the blend volume, the enthalpy and entropy of mixing. In kT units the entropic and enthalpic components of $\Delta G_m/kT$ for a binary blend are

$$\frac{\Delta S_m}{kT} = \frac{\varphi_1}{r_1 v_1}\ln\varphi_1 + \frac{\varphi_2}{r_2 v_2}\ln\varphi_2 \tag{5}$$

and

$$\frac{\Delta H_m}{kT} = \frac{\chi_{12}}{v_r}\varphi_1\varphi_2 = \tilde{\chi}_{12}\varphi_1\varphi_2 \tag{6}$$

Table 3
Thermodynamic parameters obtained from T_g shifts

PET-G/PC	φ_1^a	φ_1^b	$10^2\chi$	$10^3\ \Delta G$
G–T equation. $k = 1.87$ $T = 0$°C				
85/15	0.532	0.088	2.41	−1.3
67/33	0.794	0.209	1.95	−3.1
67/33[a]	0.867	0.145	2.21	−2.0
67/33[b]	0.661	0.228	1.88	−3.6
50/50	0.767	0.224	1.92	−3.5
33/67	0.830	0.187	2.01	−3.3
15/85	0.873	0.232	1.99	−3.6
G–T equation. $k = 1.87$ $T = 270$°C				
85/15	0.532	0.088	2.44	−2.1
67/33	0.794	0.209	1.96	−5.1
67/33[a]	0.867	0.145	2.13	−3.3
67/33[b]	0.661	0.228	1.88	−5.9
50/50	0.767	0.224	1.92	−5.5
33/67	0.830	0.187	2.01	−5.1
15/85	0.873	0.232	1.99	−5.6

φ_1^a refers to the PC-rich phase and φ_1^b refers to the PETG phase.

[a] Mixing time 5 min.

[b] Mixing time 20 min.

where φ_i and r_i are the volume fraction and the degree of polymerization of polymer i, respectively, v_r is the reference volume of the lattice, equal to $v_r = (V_{r1}V_{r2})^{1/2}$. The parameter χ_{12} is assumed to be composition independent. Differentiation of ΔG_m with the number of molecules of i, gives the chemical potential $\Delta\mu_i$ $(i = 1, 2)$. At equilibrium, equating the chemical potential of each component i in both phases (denoted by a and b), i.e. $\Delta\mu_1^a = \Delta\mu_1^b$ and $\Delta\mu_2^a = \Delta\mu_2^b$, leads to the working equation for χ_{12}:

$$\frac{\chi_{12}}{v_r} = \tilde{\chi}_{12} = \frac{\ln(\varphi_1^b/\varphi_1^a) + [1 - r_1V_{r1}/r_2V_{r2}](\varphi_2^b - \varphi_2^a)}{r_1V_{r1}[(\varphi_2^a)^2 - (\varphi_2^b)^2]} \tag{7}$$

Interchange of subscripts yields an equivalent equation. Thus χ_{12} may be calculated if phase compositions $\varphi_{1,2}^a$ and $\varphi_{1,2}^b$ are known. Moreover, the condition for phase stability at the spinodal requires that

$$\frac{\chi_c}{v_r} = \tilde{\chi}_c = \frac{1}{2}\left(\frac{1}{\sqrt{r_1V_{r1}}} + \frac{1}{\sqrt{r_2V_{r2}}}\right)^2 \tag{8}$$

Data on the present phase-separated blend to obtain phase compositions may be used applying T_{gB}–composition relationships; e.g. the Gordon–Taylor (G–T) (Eq. (9)) and Couchman (Eq. (10)) relationships:

$$T_{gB} = \frac{W_1T_{g1} + kW_2T_{g2}}{W_1 + kW_2} \tag{9}$$

$$T_{gB} = \frac{W_1\Delta Cp_1 \ln T_{g1} + W_2\Delta Cp_2 \ln T_{g2}}{W_1\Delta Cp_1 + W_2\Delta Cp_2} \tag{10}$$

where W_i, T_{gi}, ΔCp_i and $k = \Delta\alpha_2/\Delta\alpha_1$ are, respectively, the weight fraction, glass transition, specific heat increment at T_g, and the ratio of the cubic expansion coefficient differences between the viscoelastic and glassy state of polymer i. T_{gB} is the T_g of a miscible blend. In the case of a partially miscible blend T_{gB} should be replaced by the experimentally determined T_{gB}^a, where phase "a" predominates (e.g. the PC-rich phase in Table 2 has the higher T_g). In Eqs. (9) and (10), W_i may be converted to φ_i from knowledge of

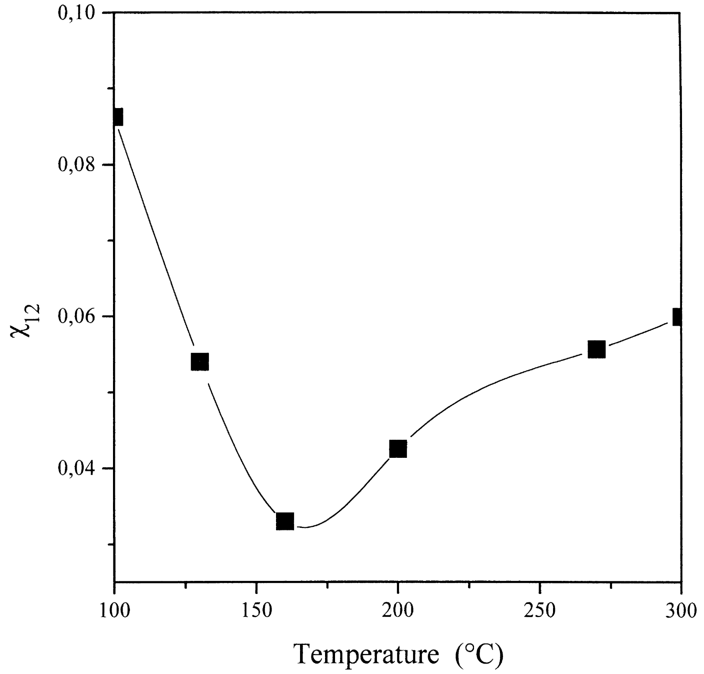


Fig. 7. Temperature dependence of polymer–polymer interaction parameter of PETG/PC blends calculated with copolymer–copolymer miscibility theory; see text.

density ρ_i. Thus using, e.g. the G–T equation, after rearrangement one obtains

$$\varphi_1^{\mathrm{a}} = \frac{-k(T_{\mathrm{gB}}^{\mathrm{a}} - T_{\mathrm{g2}})}{(T_{\mathrm{gB}}^{\mathrm{a}} - T_{\mathrm{g1}}) - k(T_{\mathrm{gB}}^{\mathrm{a}} - T_{\mathrm{g2}})} \tag{11}$$

and $\varphi_2^{\mathrm{a}} = 1 - \varphi_1^{\mathrm{a}}$.

A similar calculation can be made for phase b using data involving the $T_{\mathrm{gB}}^{\mathrm{b}}$ transition, where phase "b", rich in PETG, predominates. These φ_i values are used in Eq. (7) to obtain χ_{12} and all results for the previous calculations are listed in Table 3.

Results using G–T or Couchman equations are similar. For the former the average value of $\chi_{12}^{0°\mathrm{C}} = 2.05 \pm 0.2 \times 10^{-2}$ is obtained and for the latter $\chi_{12}^{0°\mathrm{C}} = 2.05 \pm 0.3 \times 10^{-2}$. Therefore only results for the G–T equation are listed for two temperatures. Inspection of data indicate that PC has a higher tendency to participate in the mixed phase compared to PETG. Also, predicted χ_{12} values are smaller than values obtained by the copolymer–copolymer miscibility theory $\chi_{12} = 2.05 \times 10^{-2}$ vs 5.6×10^{-2} at 270°C. However they are still unfavourable for mixing and very close to the χ_{c} calculated to be $\chi_{\mathrm{c}} = 1.72 \times 10^{-2}$. χ_{12} values are little affected by temperature or composition. $\Delta\mathrm{G} \leq 0$, which means that mixing proceeds spontaneously. This is attributed to the entropic contribution (Eq. (5)) to the free energy of mixing because polymer MW is not very high.

As to the origin of the partial miscibility observed, it is proposed that it may be attributed to weak intermolecular π-electron interactions between the terephthalate units of PETG and the aromatic rings of PC in analogy to other PET/polyester blends [1,2,46].

Data used in previous calculations are as follows: The specific thermal expansivity values in the glassy (e_{g}) and the viscoelastic state (e_{l}) were 2.9×10^{-4} and $5.9 \times 10^{-4}\ \mathrm{cm}^3\ \mathrm{g}^{-1}\ \mathrm{K}^{-1}$, respectively, for PC and 2.4×10^{-4} and $7.4 \times 10^{-4}\ \mathrm{cm}^3\ \mathrm{g}^{-1}\ \mathrm{K}^{-1}$, respectively, for PETG [47]. Density of PC = $1.20\ \mathrm{g\ cm}^{-3}$, of the poly(cyclohexane 1,4-dimethanol terephthalate) $\rho = 1.19$ and of the PET moiety $\rho = 1.335\ \mathrm{g\ cm}^{-3}$ [48]. Molar volumes are: $\bar{V}_{\mathrm{PETG}} = 172\ \mathrm{cm}^3\ \mathrm{mol}^{-1}$ adopted as V_{r}, $\bar{V}_{\mathrm{PC}} = 211.9\ \mathrm{cm}^3\ \mathrm{mol}^{-1}$. Using Hoy's molar attraction constants [49] the calculated solubility parameters (in $(\mathrm{cal\ cm}^{-3})^{1/2}$) are, $\delta_{\mathrm{PC}} = 10.06$ and $\delta_{\mathrm{PETG}} = 9.97$.

5. Conclusions

1. Melt-mixed PETG/PC blends show morphological and mechanical properties characteristic of a nearly miscible polymeric alloy.
2. Analysis of viscoelastic data supports this view. Also, that the mixing process though associated with a favourable ΔG_{m} leads to an unstable blend at the temperature where it was prepared.
3. Though transesterification may not be ruled out, spectroscopic evidence and the limited mixing time employed support the proposition that its role in the compatibilization process is very limited.

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