The effect of compatibilization on blends of polypropylene with a liquid-crystalline polymer*

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Compatibilization of blends of polypropylene (PP) with a thermotropic liquid-crystalline polymer (LCP) was considered in an attempt to improve the mechanical properties obtained by blending alone. The effect of compatibilization was investigated on injection-moulded plaques and tensile bars. Significant improvements were seen in the values of tensile modulus and strength. Substantial improvements were also obtained for torsion modulus and compliance. The surface finish of the blends was very smooth and homogeneous. The morphological investigations showed that the key to property enhancements lay in improved interfacial adhesion and a less phase-separated and more uniform dispersed-phase (LCP) distribution. The properties of the compatibilized PP/Vectra B blends compared favourably with those of the glass-filled PP.

(Keywords: compatibilization; liquid-crystalline polymer; polypropylene; maleated polypropylene; *in situ* composites)

INTRODUCTION

Polymer blends that comprise a thermoplastic matrix reinforced with liquid-crystalline polymers (LCPs) have been an area of considerable interest to researchers in the last few years[1-9]. The LCPs under certain processing conditions[10,11] can develop a fibrillar morphology with a high degree of orientation leading to enhanced mechanical properties of these *in situ* reinforced composites. Both engineering thermoplastics and commodity resins have been reinforced using various LCPs. Several of the engineering thermoplastics have melting and processing temperature ranges that overlap with those of the LCPs, thereby facilitating the processing of their blends. However, LCPs usually have higher processing/melting temperatures than commodity resins such as poly(ethylene terephthalate) (PET) or polypropylene (PP). Consequently, blending LCPs with these thermoplastics in the same extruder or moulding unit becomes difficult owing to degradation of the matrix polymer at the high temperatures where the LCPs are processable. Thermoplastic/LCP pairs that may not have an overlapping nominal processing temperature have been successfully blended using a novel two-extruder blending technique developed in our laboratory[12-14]. The blending method was seen to have significant advantages over the more conventional blending in a single-screw extruder in terms of both blend morphology and mechanical properties of the resultant blend.

Excellent mechanical properties have been achieved for blends of thermoplastics and LCPs when partial miscibility exists[15] and on occasions where they are not miscible or compatible[2]. However, the majority of the thermoplastics that have been studied are incompatible with the LCPs. This incompatibility between the matrix polymers and reinforcing LCPs gives rise to poor interfacial adhesion[1,5-7,9], which leads to a reinforcing effect less than that expected from the law of mixtures for both modulus and strength of these composites. Furthermore, the surface appearance of injection-moulded parts can be unacceptable.

Reinforcement of PP with several LCPs has been attempted by Baird and coworkers[16,17] as well as other researchers[18]. Although the blends exhibited improvements in modulus, they tend to show no improvements (and in some cases a decrease) in the values of tensile strength compared to that of pure PP. The PP/LCP blends also tend to have poor surface finish. Poor adhesion between PP and the LCPs coupled with poor dispersion (or non-uniform distribution) of the LCP phase are an indication of incompatibility between the polymers. The decreased tensile strength, a less-than-expected increase in modulus and poor surface appearance of the blends were attributed to the incompatibility between PP and the LCPs.

Compatibilization has been known to overcome the problems of poor dispersion and poor adhesion in blends of other incompatible polymers[19]. Compatibilizing agents are block or graft copolymers possessing segments with chemical structures or solubility parameters that are similar to those of the polymers being blended. Acting as polymeric surfactants, these agents reduce the interfacial tension, which promotes interfacial adhesion, a finer

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dispersion and a more uniform distribution of the dispersed phase. In some cases, the emulsifying ability of the compatibilizer also results in a reduction in the polydispersity of the disperse phase particle size[20]. Better dispersion and adhesion result in improved mechanical properties of the compatibilized blends[19,21]. Our previous attempts to compatibilize a PP/LCP blend resulted in significant enhancement in tensile modulus, tensile strength and surface finish relative to those of the non-compatibilized blends[17]. The study was conducted using injection-moulded plaques. The LCP content was 20 and 30 wt% in the blends. The improvements in properties were attributed to better adhesion and dispersion in the blends.

In light of the above-mentioned success in compatibilizing a PP/LCP blend, our current objective is to investigate whether compatibilization can lead to enhancements in mechanical properties and improvements in surface finish of blends of PP with an LCP over a wide range of LCP content. The LCP used here is Vectra B950, which is a poly(ester-*co*-amide). The blends are processed by injection moulding and the effect of compatibilization is examined by analysis of fracture surfaces and the measurement of physical properties. In a subsequent publication, the effect of compatibilization on injection-moulded blends of PP with two other LCPs (which are copolyesters) will be examined.

EXPERIMENTAL

Materials

The LCP used for this study is Vectra B950, which was purchased from Hoechst Celanese. It is believed to be a wholly aromatic liquid-crystal poly(ester-*co*-amide) composed of 58 mol% hydroxynaphthoic acid, 21 mol% terephthalic acid and 21 mol% of hydroxyacetanilide. Its possible structure can be found in ref. 7. Vectra B950 will henceforth be referred to as Vectra B. The matrix PP, Profax 6823, was supplied by Himont. The compatibilizer is a maleic-anhydride-grafted PP, the exact nature of which as well as the method of sample preparation, which involves pre-blending of the compatibilizer and the matrix PP in a fixed ratio by weight, are being described elsewhere[22].

Injection moulding

Before processing, the LCP pellets were dried for at least 24 h in a convection oven at 120°C. The dried pellets were then tumbled together with PP pellets in a predetermined weight ratio for making blended injection-moulded plaques and tensile bars. Compatibilized PP/LCP plaques and tensile bars were moulded in a similar fashion except that the sample preparation involving the compatibilizer and the matrix PP was different and as mentioned above has been described elsewhere[22]. Compatibilized and uncompatibilized injection-moulded plaques and tensile bars were made containing 20, 30, 50 and 80 wt% LCP.

Rectangular plaques of approximately 75 mm by 80 mm by 1.75 mm thick and tensile bars of approximately 63 mm by 1 mm by 1.7 mm thick were injection moulded using an Arburg model 222-55-20. For processing the compatibilized and uncompatibilized blends, the barrel temperatures of the extruder in the injection moulder were 230°C in the first zone and 295°C in the second and third zones. The nozzle temperature was 250°C and the mould was kept at room temperature.

Mechanical properties

The tensile modulus and strength of the injection-moulded plaques and tensile bars were measured using an Instron mechanical tester (model 4204). For the plaques, test samples were strips approximately 80 mm long and 12.5 mm wide. The crosshead speed was 2 mm min^{-1}. The strain was measured using an extensiometer (Instron model 2630-25), which can measure a maximum strain of 10%. The toughness measurements were made using the tensile bars and were calculated as the area under the stress–strain curve until the sample broke. The arithmetic average and the standard deviation of the tensile properties were calculated using a minimum of five samples.

The dynamic torsional properties of the plaques were obtained using a Rheometrics Mechanical Spectrometer, RMS 800. In particular, the storage modulus (G') was obtained as a function of temperature using an angular frequency of 10 rad s^{-1} and a strain of 0.05 to 0.07%. The dynamic creep compliance was also measured as a function of frequency at a strain of 0.05 to 0.1%. The creep measurements were done at 30 and 100°C. For both tests, the sample was a rectangular piece measuring approximately 50 mm long, 12.5 mm wide and 1.1 to 1.6 mm thick.

Morphological studies

The morphology was determined by scanning electron microscopy (SEM), using a Cambridge Stereoscan S200 with an accelerating voltage of 25 kV. The samples were fractured after immersing them in liquid nitrogen for 5 min. The fractured samples were then placed on aluminium stubs and sputter-coated with gold using a sputter coater.

RESULTS AND DISCUSSION

To investigate the effects of compatibilization, the physical properties of the compatibilized and the uncompatibilized injection-moulded blends of PP and Vectra B will be compared first. This comparison will be done for both plaques and tensile bars that have different deformation histories during injection moulding. The polymer experiences higher extensional deformations while flowing through the converging section of the tensile-bar mould than in the plaque mould. The difference, if any, between the physical properties of the blends with and without compatibilization will be related to any observed difference in their respective morphologies. Finally, the properties of the compatibilized blends will be compared with those of glass-filled PP.

The tensile properties of compatibilized and uncompatibilized plaques for different blend compositions are presented in *Table 1*. The tensile modulus improved with the increase in LCP content for the uncompatibilized blends, but on compatibilization, there were further significant improvements in the moduli of the blends. The compatibilized blends showed an additional 30 to 40% increase in modulus over the uncompatibilized blends. The tensile strengths of the uncompatibilized blends showed virtually no improvements over that of pure PP for PP/Vectra B 80/20 and 50/50 blend compositions and actually dropped below that of PP for

Table 1 Tensile properties[a] of PP/Vectra B blends obtained from plaques with and without compatibilization

	Machine direction		Transverse direction	
Materials[b]	Modulus (GPa)	Strength (MPa)	Modulus (GPa)	Strength (MPa)
PP	1.384 (0.075)	26.89 (1.10)	1.098 (0.027)	25.76 (0.34)
PP/Vectra B 80/20	2.553 (0.169)	24.04 (1.14)	1.366 (0.089)	13.69 (1.03)
PP/Vectra B 80/20 (comp.)	3.209 (0.262)	34.01 (1.06)	1.937 (0.214)	22.44 (0.27)
PP/Vectra B 70/30	3.003 (0.289)	19.71 (0.59)	1.493 (0.086)	11.38 (0.44)
PP/Vectra B 70/30 (comp.)	4.101 (0.401)	37.55 (3.97)	2.216 (0.113)	23.41 (0.64)
PP/Vectra B 50/50	5.767 (0.221)	26.36 (1.12)	1.489 (0.147)	9.73 (1.16)
PP/Vectra B 50/50 (comp.)	7.355 (0.215)	52.43 (3.50)	2.395 (0.64)	19.93 (1.06)
PP/Vectra B 20/80	8.379 (0.523)	43.69 (3.30)	1.857 (0.190)	14.38 (0.47)
PP/Vectra B 20/80 (comp.)	11.94 (0.584)	64.85 (1.71)	2.455 (0.135)	18.85 (1.57)
Vectra B	17.22 (1.65)	137.0 (11.48)	3.04 (0.108)	28.28 (1.96)

[a] Standard deviations are given in parentheses
[b] Compatibilized indicated by (comp.)

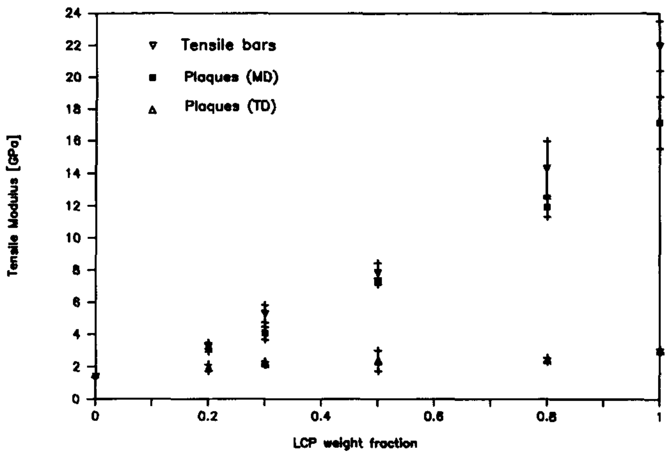

Figure 1 Tensile modulus *versus* LCP content of compatibilized PP/Vectra B blends

the blend containing 30 wt% LCP. The tensile strengths of the compatibilized samples not only were higher than the uncompatibilized blends by 40 to 100%, but also were substantially enhanced over that of PP. As the LCP content in the blend was increased from 20 to 80%, the tensile strengths of the compatibilized blends increased from 1.25 to 2.4 times that of PP and the tensile moduli of the compatibilized blends increased by 2.3 to 8.6 times that of PP. Thus compatibilization improved both the modulus and the strength of the blended plaques. However, even with compatibilization, the moduli of the blends were below those values predicted by the law of mixtures as seen in *Figure 1*.

The effects of compatibilization on transverse direction properties are also reported in *Table 1*. The properties of LCPs are known to be highly anisotropic when processed by techniques involving one-dimensional flows[2,23]. Attempts to generate biaxial orientation have been reported by Blizzard and coworkers[24,25]. The anisotropy in the end-gated Vectra B specimen is illustrated by the fact that there is a five-fold difference in both tensile modulus and strength measured along the machine direction relative to that measured in the transverse direction, as observed from *Table 1*. Anisotropy in the mechanical properties of the blends is also observed. Uncompatibilized blends exhibited higher moduli than PP in the transverse direction, and compatibilization improved the transverse direction modulus of the blends by 30 to 60% over the uncompatibilized blends. In fact it is observed from *Figure 1* that the transverse moduli were higher than those predicted by the law of mixtures for the compatibilized blends containing 20 to 50 wt% LCP and were slightly lower than that predicted by the law of mixtures for the compatibilized blend containing 80 wt% LCP. However, the transverse direction strengths were still lower than those of PP even with compatibilization. The low strengths for the blends are not unexpected as the strength of the Vectra B is similar to that of PP in the transverse direction.

The tensile properties of PP/Vectra B blends obtained by using tensile bars with and without compatibilization are listed in *Table 2*. For the same blend composition, the properties of the tensile bars in *Table 2* are observed to be better than those obtained on PP/Vectra B plaques, which are reported in *Table 1*. The difference in tensile properties between the tensile bars and the plaques may be attributed to the higher orientation and higher-aspect-ratio fibrils of the LCP phase owing to the stronger elongational flow in the neck region of the tensile bars. As with the plaques, compatibilization enhances both the moduli and strengths of the tensile bars for all blend compositions. The levels of enhancement vary from 10 to 40% for the modulus and from 40 to 80% for the strength. The extent of increase in modulus and strength on compatibilization is slightly less for the tensile bars than for the plaques. As with the plaques, the moduli of the tensile bars are below those predicted by the law of mixtures, as seen in *Figure 1*.

Table 2 Tensile properties[a] of PP/Vectra B blends obtained from tensile bars with and without compatibilization

Materials[b]	Tensile modulus (GPa)	Tensile strength (MPa)	Elong. yield (%)	Toughness (kJ m^{-3})
PP	1.369	31.24		
PP/Vectra B 80/20	2.876 (0.089)	26.45 (0.34)	2.27	648[c]
PP/Vectra B 80/20 (comp.)	3.295 (0.188)	36.85 (0.98)	2.00	786[c]
PP/Vectra B 70/30	3.674 (0.395	27.26 (2.28)	1.50	662[c]
PP/Vectra B 70/30 (comp.)	5.280 (0.555)	50.31 (1.97)	1.47	359
PP/Vectra B 50/50	6.474 (0.825)	38.78 (4.07)	0.98	610
PP/Vectra B 50/50 (comp.)	7.832 (0.640)	58.69 (6.26)	1.04	362
PP/Vectra B 20/80	12.97 (0.536)	78.23 (7.7)	0.85	568
PP/Vectra B 20/80 (comp.)	14.31 (1.686)	112.0 (6.53)	1.04	777
Vectra B	21.98 (1.543)	227 (32.0)	1.00	1187

[a] Standard deviations are given in parentheses
[b] Compatibilized indicated by (comp.)
[c] Toughness up to 3% strain

The ductility and the toughness of the blends were obtained from the stress–strain curves of the PP/Vectra B blend tensile bars. The addition of LCP changes the material response from ductile to brittle. PP is very ductile, with an elongation to break that is approximately two orders of magnitude higher than those of the blends, and has a toughness that is significantly higher than those of the blends. It is observed from *Table 2* that the elongation at yield drops off as the LCP content is increased, and compatibilization did not alter these values. Most blended samples broke below 3% strain without displaying any significant ductility after the yield point. For a few samples that broke above 3% strain, toughness was calculated until 3% strain for comparison purposes. The toughness of the compatibilized blend was higher than those of the uncompatibilized blends at 20 and 80 wt% LCP but the toughness decreased on compatibilization for the blends with intermediate LCP content of 30 and 50 wt%. A possible explanation for the variation in toughness of compatibilized blends will be presented later when the morphologies of the blends will be discussed.

The dynamic torsional modulus as a function of temperature for the various blends and PP has been studied using the RMS, and the results are compared in *Figure 2*. The dynamic modulus (G') increased on compatibilization at the lower temperature for all blend compositions. But at higher temperatures, the difference in torsion moduli between the compatibilized and uncompatibilized blends was indistinguishable. Thus in order to avoid putting too many results on one plot, only the results of the compatibilized blends are presented here. The torsion moduli of the PP/Vectra B compatibilized blends increased with increasing LCP content, and the improvements are observed for the entire temperature range scanned. The differences in G' between the blends and PP are higher at higher temperatures than at lower temperatures. The G' of PP decreases with increasing temperature faster than that of the blends as PP approaches its melting point of 165°C. The ability of the LCP to maintain the moduli of the blend at elevated temperatures is expected to raise the heat distortion temperature for the PP/Vectra B blend over that of PP.

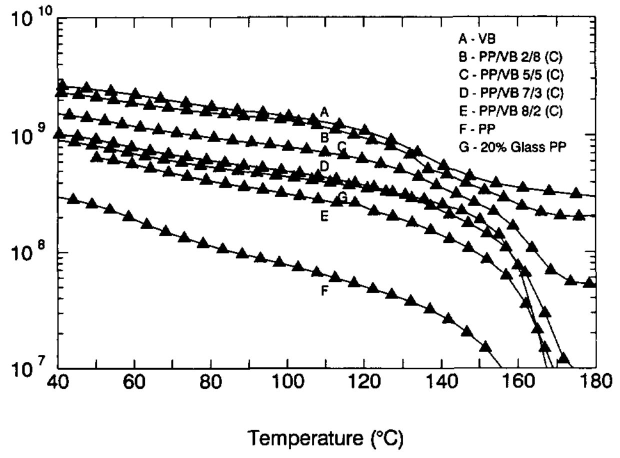

Figure 2 Torsion modulus *versus* temperature of PP, Vectra B, compatibilized PP/Vectra B blends and glass-filled PP

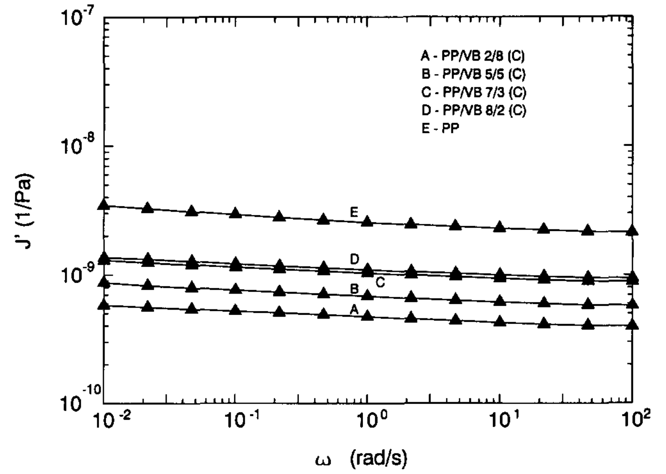

Figure 3 Dynamic modulus *versus* frequency of PP and compatibilized PP/Vectra B blends at 30°C

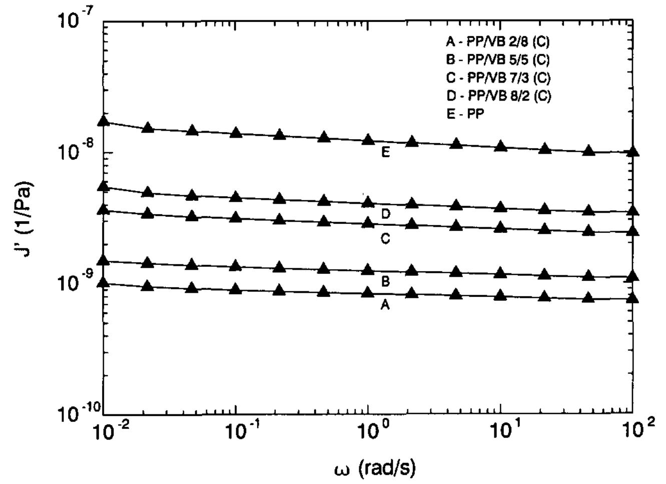

Figure 4 Dynamic modulus *versus* frequency of PP and compatibilized PP/Vectra B blends at 100°C

The dimensional stability of the blends under load is examined by monitoring the dynamic compliance against frequency at different temperatures. The dynamic compliance (J') is obtained from the dynamic torsional modulus (G') in a frequency sweep test by the application of the transformation:

$$J' = (1/G')/(1 + \tan^2 \delta)$$

where $\tan \delta = G''/G'$ and G'' is the loss modulus. There was no significant difference seen between the compliances of the compatibilized and uncompatibilized blends, and only the data for the compatibilized blends and PP are presented in *Figures 3* and *4* at 30 and 100°C, respectively. The dynamic compliance at a frequency χ is qualitatively equivalent to a transient compliance at $t = 1/\chi$ (ref. 26), and it is observed that the compliance was lower at higher frequency (i.e. shorter times) and higher at lower frequency (i.e. longer times). This behaviour is expected as PP creeps with time on application of stress as evidenced in other semicrystalline materials[23]. At 30°C, the addition of 20% LCP significantly improved (about five times) the compliance, which was further improved on increasing the LCP content. The compliances of the PP, PP/Vectra B 8/2, and PP/Vectra B 2/8 at 100°C were approximately 7, 3.5 and 1.5 times higher, respectively, than at 30°C. The higher LCP content is more effective in resisting deformation at higher temperatures. The LCP reinforcements thus added to the dimensional stability of the blends.

It should be noted here that there is a dramatic difference in the surfaces of the blend samples with and without compatibilization. As illustrated in *Figure 5*, unlike the blends without compatibilizers, the compatibilized blends have a smooth and polished surface. Also, the surfaces of the compatibilized blends are much more homogeneous in appearance than the distinct two-phase appearance of the uncompatibilized blends.

Scanning electron microscopy was used to analyse the morphologies of the compatibilized and the uncompatibilized blends in an effort to determine the difference in their properties. In *Figure 6* are shown the fracture surfaces of the PP/Vectra B 8/2 blends with and without compatibilization. The samples were fractured along the flow direction, which is horizontal in *Figure 6*. In the uncompatibilized blends, the long LCP fibrils can be seen oriented in the flow direction. However, the LCP fibrils are seen to be bunched together, indicating poor dispersion. The micrographs also demonstrate the poor adhesion between the two phases, which leads to whole fibrils being pulled out during the fracturing of the samples. In contrast, in the compatibilized blends the fracture is seen to occur within the fibrils, reflecting better bonding or adhesion between the two phases. Furthermore, in the compatibilized blends it appears that the LCP fibrils are more evenly distributed and finer in size than in the uncompatibilized blends. While the finer LCP fibrils have possibly resulted in higher modulus, the improved tensile strength can be attributed to better adhesion between the phases. Improved adhesion and finer and more uniform dispersion have been seen on compatibilization of other polymer blends[19–21]. These phenomena were thought to be brought about by lowering of the interfacial tension between the two phases.

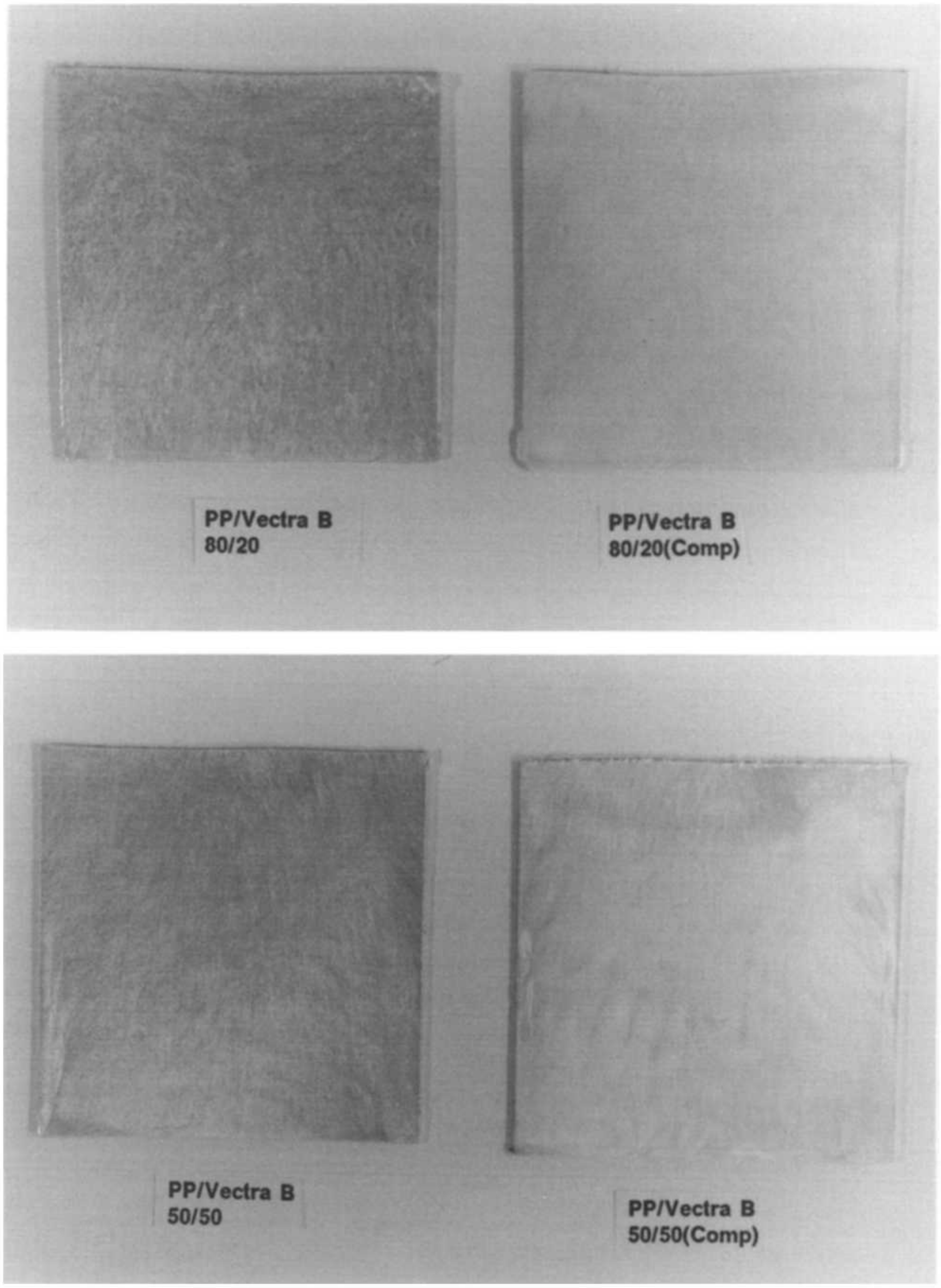

Figure 5 Surface appearances of uncompatibilized (left) and compatibilized (right) PP/Vectra B blend plaques. At the top are 8/2 blends and at the bottom are 5/5 blends

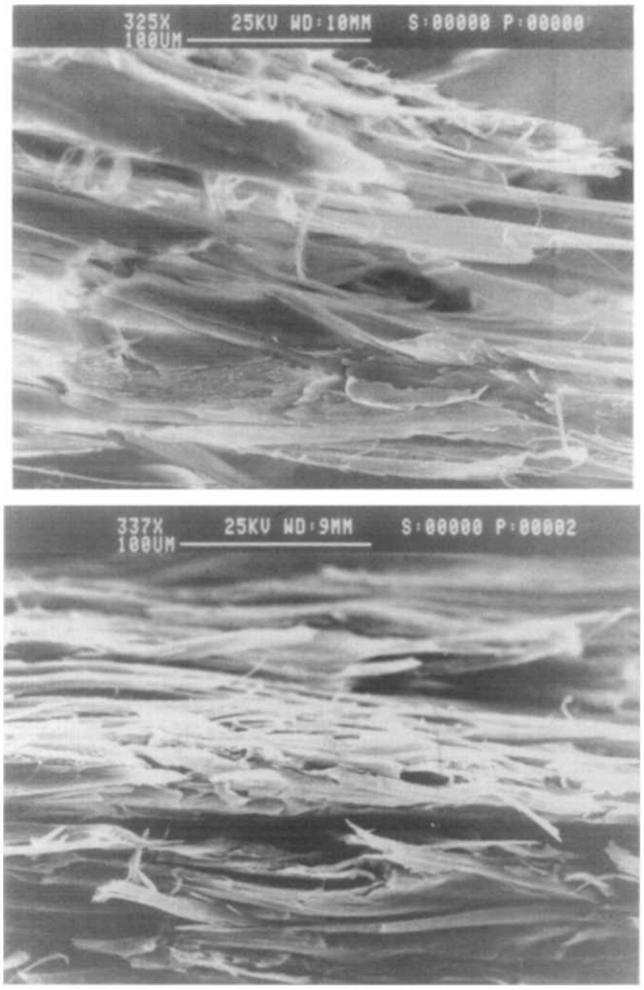

Figure 6 Scanning electron micrographs of fracture surfaces of uncompatibilized PP/Vectra B 8/2 (top) and compatibilized PP/Vectra B 8/2 (bottom) plaques. Fracture is along the flow direction

Since a similar change in morphology is seen to occur on compatibilization of PP/Vectra B blends, it can be speculated that the mechanism of compatibilization is similar to those of the other compatibilized blends reported earlier[19–21].

A similar difference in morphologies is seen in the compatibilized and uncompatibilized PP/Vectra B blends containing 50 wt% LCP. In *Figure 7* at 50 wt% LCP content, the LCP phase seems to be forming interconnected sheets in the uncompatibilized blend. In contrast, the compatibilized blends exhibit a much better dispersion in which the individual LCP fibrils can be identified. It is believed that the compatibilization process reduces the tendency of the LCP to coalesce by its emulsifying effect. In addition, for the compatibilized blend a number of LCP fibrils are seen to have broken during the fracturing process, showing the remaining part adhered to the matrix. The results of compatibilization on the morphology of PP/Vectra B 8/2 and PP/Vectra B 5/5 blends are quite similar. The differences between the uncompatibilized and compatibilized PP/Vectra B 2/8 blends as seen in *Figure 8* are not as distinct as those of 20 and 50 wt% blends. However, it appears that the LCP is much more dispersed in the compatibilized blend. Hence, it is seen that the morphological investigation agrees well with the mechanical property enhancements observed on compatibilization.

The reason for improvement in toughness on compatibilization in some blends and a drop in toughness of other blends can possibly be explained from examination of the morphology and the stress–strain curves. For the 70/30 and 50/50 compositions there is an apparent decrease in toughness. This may be due to a change in the nature of the fracture on compatibilization. With compatibilization, the interfacial adhesion between PP and Vectra B increases. The failure mechanism changes when this occurs, in that Vectra B dominates the fracture process and hence a more brittle type of fracture occurs with consequent reduction in toughness. At these levels of LCP, without compatibilization a more ductile type of fracture takes place as Vectra B is pulled out of the deforming PP matrix. The fracture phenomenon is dominated by Vectra B for both the compatibilized and uncompatibilized PP/Vectra B 20/80 blends. However, on compatibilization the higher modulus and strength of the blend at the same low ductility give better toughness. In other words, at the higher LCP concentration with compatibilization the blends are approaching the higher toughness of the LCP. At 20 wt% LCP content, the compatibilization process produces a finer and more uniform dispersion of the LCP phase and a continuous matrix-phase PP. This continuous PP phase exhibits a higher ductility and shows a consequent improvement in

Figure 7 Scanning electron micrographs of fracture surfaces of uncompatibilized PP/Vectra B 5/5 (top) and compatibilized PP/Vectra B 5/5 (bottom) plaques. Fracture is along the flow direction

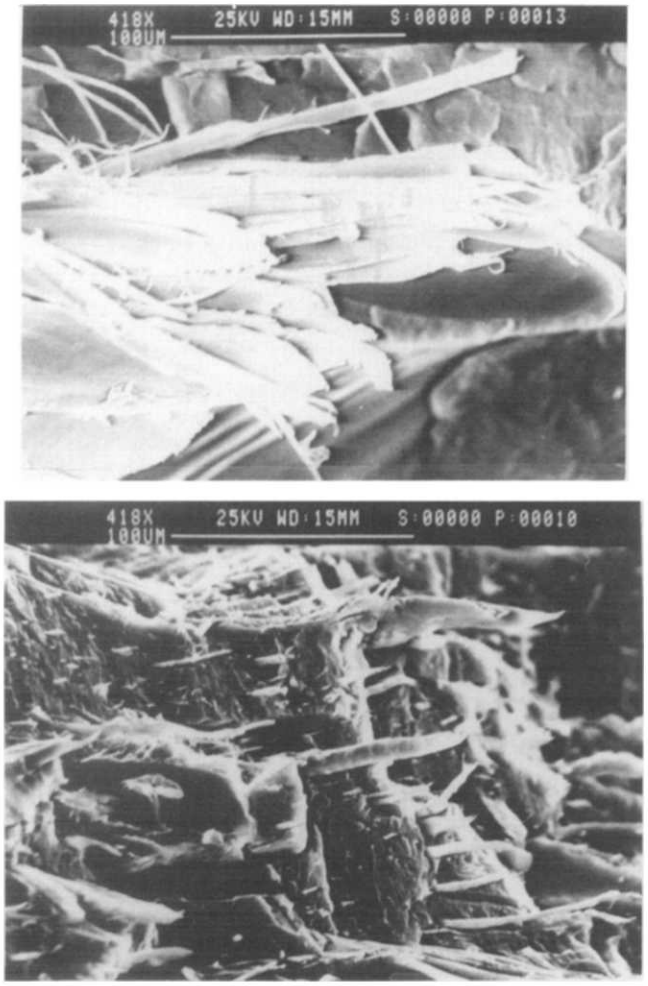

Figure 8 Scanning electron micrographs of fracture surfaces of uncompatibilized PP/Vectra B 2/8 (top) and compatibilized PP/Vectra B 2/8 (bottom) plaques. Fracture is along the flow direction

Table 3 Tensile properties of glass-filled PP

	Machine direction		Transverse direction	
Materials	Modulus (GPa)	Strength (MPa)	Modulus (GPa)	Strength (MPa)
20% glass-filled PP	3.66	49.05	2.78	33.17

toughness than the less dispersed uncompatibilized blends. Furthermore, there is some difficulty in measuring the area under the stress–strain curves and a fair comparison may not be possible.

The question remains as to how the performance of the compatibilized PP/Vectra B blends compares with that of glass-filled PP. It is observed from *Figure 2* that a 20 wt% glass-filled PP has a torsional modulus *versus* temperature profile intermediate to that of the compatibilized PP/Vectra B blends containing 20 and 30 wt% LCP. Also the temperature dependence of G' for the compatibilized PP/Vectra B 7/3 blend appears to be nearly the same as that of glass-filled PP, implying that their heat distortion characteristics are similar. The tensile modulus and strength of the glass-filled PP plaques are presented in *Table 3*. When these values are compared with those for the compatibilized blend plaques in *Table 1*, the machine direction modulus lies between those of the compatibilized PP/Vectra B 80/20 and 70/30 blends while the strength lies between those of the compatibilized PP/Vectra B 70/30 and 50/50 blends. The tensile modulus of the PP/Vectra B 80/20 compatibilized blends for the case of tensile bars is similar to and the strength is lower than that of the glass-filled PP. Both the modulus and the strength of the PP/Vectra B 70/30 compatibilized blends for the case of tensile bars are better than those of the glass-filled PP. On the other hand, the transverse direction properties of the glass-filled PP are better than those of the compatibilized PP/Vectra B blends. The mechanical anisotropy is certainly one of the shortcomings associated with these systems, but efforts to overcome this problem are being made[16]. The blends have more processing options, such as extrusion, calendering and thermoforming[17], which may not be available to glass-filled systems. Also the surfaces of the compatibilized blends are far superior to that of glass-filled PP.

CONCLUSIONS

Several conclusions can be drawn from the compatibilization of blends of PP with Vectra B.

Significant improvements in both tensile modulus and strength were obtained on compatibilization of blends of PP and Vectra B. The properties of compatibilized samples in the case of tensile bars were higher than those of the compatibilized samples in the case of plaques, indicating the importance of both orientation and interfacial adhesion in the performance of the blends. Enhancements in the tensile modulus ranging from 2.4 to 10.4 times that of PP and enhancements in strengths of 1.3 to 3.6 times that of PP were observed for the compatibilized samples in the case of tensile bars with the LCP content varying from 20 to 80 wt%.

The transverse moduli of the compatibilized blends are higher than those predicted by the law of mixtures for most blend compositions. However, the transverse strengths are below that of PP even with compatibilization.

The blends are more brittle than PP and the toughness improved on compatibilization for some blend compositions and not for others.

The dynamic storage modulus and creep compliance are substantially improved for the compatibilized blends as compared to PP and over a large range of temperature. The compatibilized blends should have higher heat distortion temperature and greater dimensional stability than PP.

The improvements in properties are attributed to improved adhesion between the two phases, and a finer and more uniform distribution of the LCP phase brought about by compatibilization.

The PP/Vectra B compatibilized blends at 20 and 30 wt% LCP have comparable properties to those of 20 wt% glass-filled PP. However, the blends lack the transverse direction properties of the glass-filled systems. The compatibilized blends have a much better surface appearance than glass-filled PP.

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