

Chapter 16 -1. Polymer Blends (Processing)

- Polymer blend

가 .

(i) compatibility (): mechanically engineering partially miscible () compatible .

(ii) Miscibility : $\Delta G_{mix} = \Delta H_{mix} - T \Delta S_{mix}$
 ΔS_{mix} ΔG_{mix} 가 negative . ,
 homogeneous .

- Miscibility

(1) Film (transparency) – amorphous polymer
 amorphous polymer blending ,
 film , amorphous polymer partially
 crystalline polymer blending , miscible
 opaque film , film 가
 miscibility 가 .

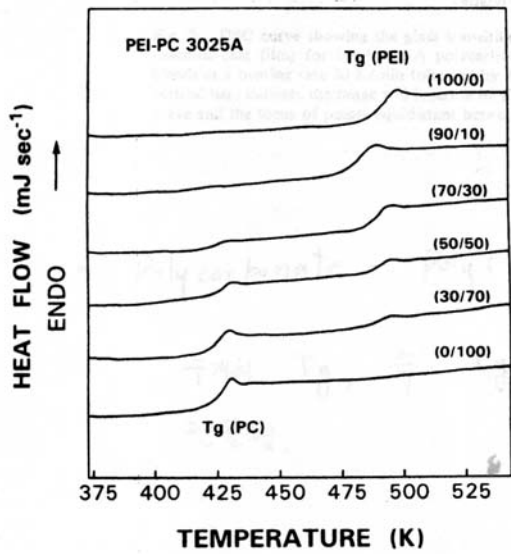
(2) DSC(differential scanning calorimeter)

(glass transition temp, Tg) single Tg가

- a homogeneous blend exhibits one Tg

- mixing

amorphous fraction mixing interphase가 .

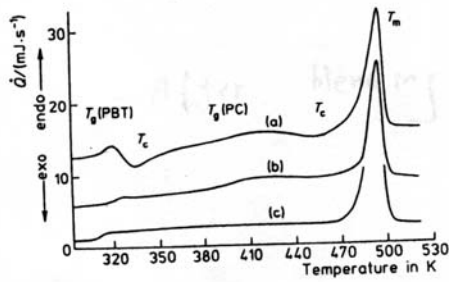


* Reference
 Chun et al.,
 Polymer Engineering & Sci.
 Vol. 36, No. 22,
 page 2694-2902 (1996).

Fig. 1. Thermograms showing the glass transition temperature (T_g) of the PEI and PC of various composition for PEI-PC 3025A blends.

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W. N. Kim, C. M. Burns



* Reference, Kim & Burns
 Makromol. Chemie
 190, page 661-676 (1989)

Fig. 1. DSC curves showing the glass transition temperature T_g , the crystallization temperature T_c , and the melting point T_m , of 0,50 mass fraction PC (extrudate) for bisphenol-A polycarbonate/poly(butylene terephthalate), (PC-PBT) blends: (a) cooling in liquid nitrogen; (b) cooling rate of 320 K/min followed by a liquid-nitrogen cooling; (c) cooling in liquid nitrogen for PBT homopolymer

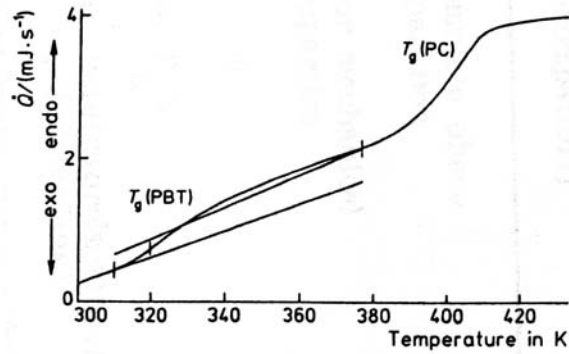


Fig. 2. DSC curve showing the glass transition temperature (T_g) of 0,60 mass fraction PC (solution-cast film) for bisphenol-A polycarbonate/poly(butylene terephthalate), (PC-PBT) blends at a heating rate 20 K/min followed by 320 K/min cooling immediately to 288 K. The vertical bars indicate the range and location of T_g (PBT). The T_g is the intersection of the DSC curve and the locus of points equidistant between the two extrapolated lines

- Polycarbonate - Poly(butylenes terrephtalate) Blends,

- T_g , $T_g(PC)$ $T_g(PBT)$ 가 .

- Before blending, $T_g(PC)=421(K)$

$$T_g(PBT)=314.6(K)$$

- After blending, PC/PBT=60/40(wt %)

$$T_g(PC) = 400.1(K)$$

$$T_g(PBT)=321.1(K)$$

- , $T_g(PC)$, $T_g(PBT)$ 가 .

Table I. Behavior and Properties of Immiscible, Semi-miscible and Miscible Blends (5)

Immiscible blends (incompatible)	Semi-miscible blends (compatible)	Miscible blends (compatible)
Complete phase separation	Partial phase separation	Homogeneous blend*
Poor mechanical properties	Good mechanical properties	Good mechanical properties
$\Delta G > 0$	$\Delta G > 0$	$\Delta G < 0$
Two T_g 's e.g. poly(caprolactone) / poly(ethylene)	Two T_g 's e.g. poly(propylene) / poly(ethylene)	One T_g e.g. poly(caprolactone poly(vinylchlorid

3. Thermodynamics of Polymer-Polymer Miscibility

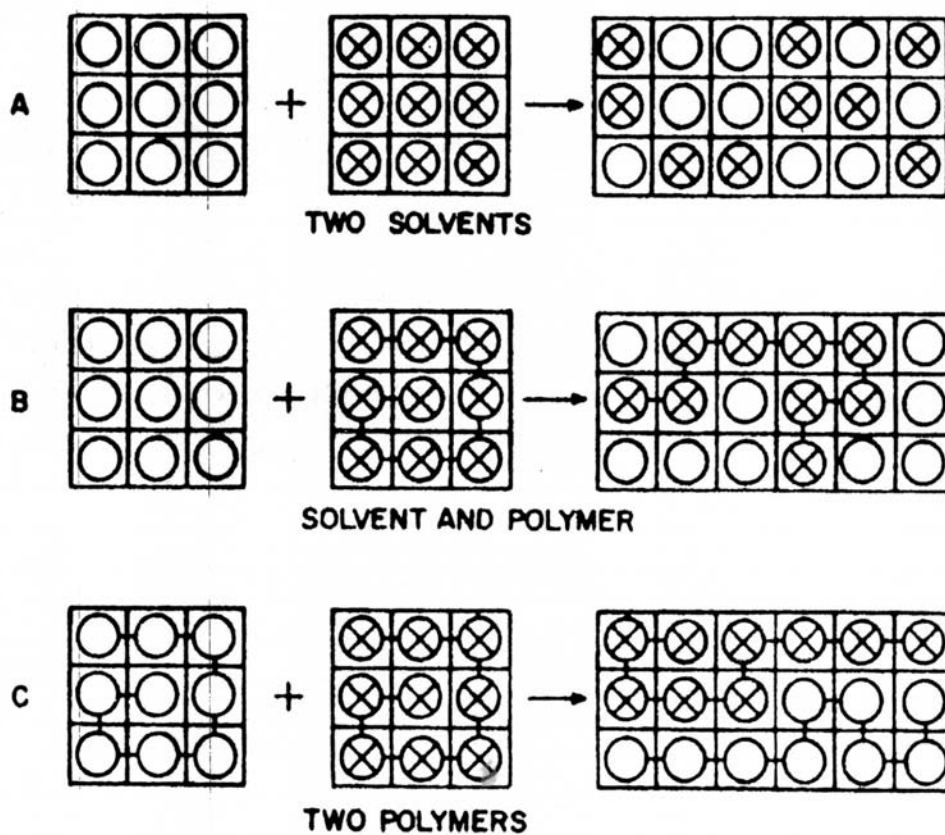
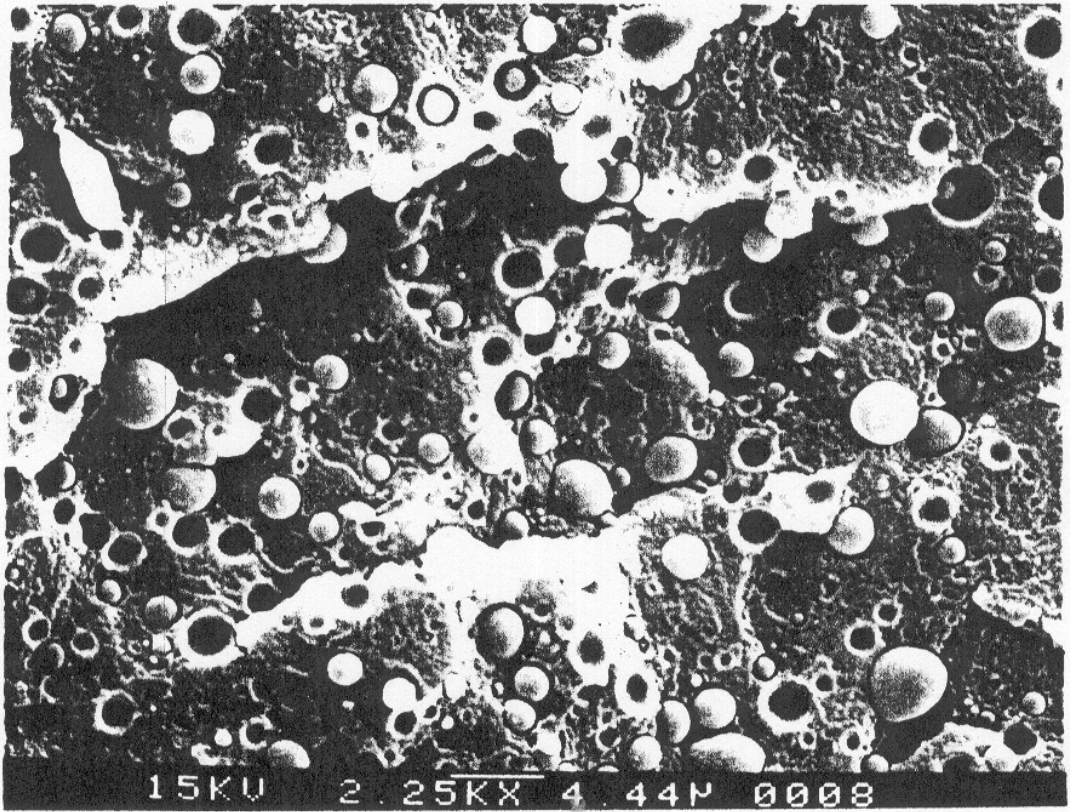


Figure . Schematic illustration of the numbers of possible arrangements in a small molecule mixture.



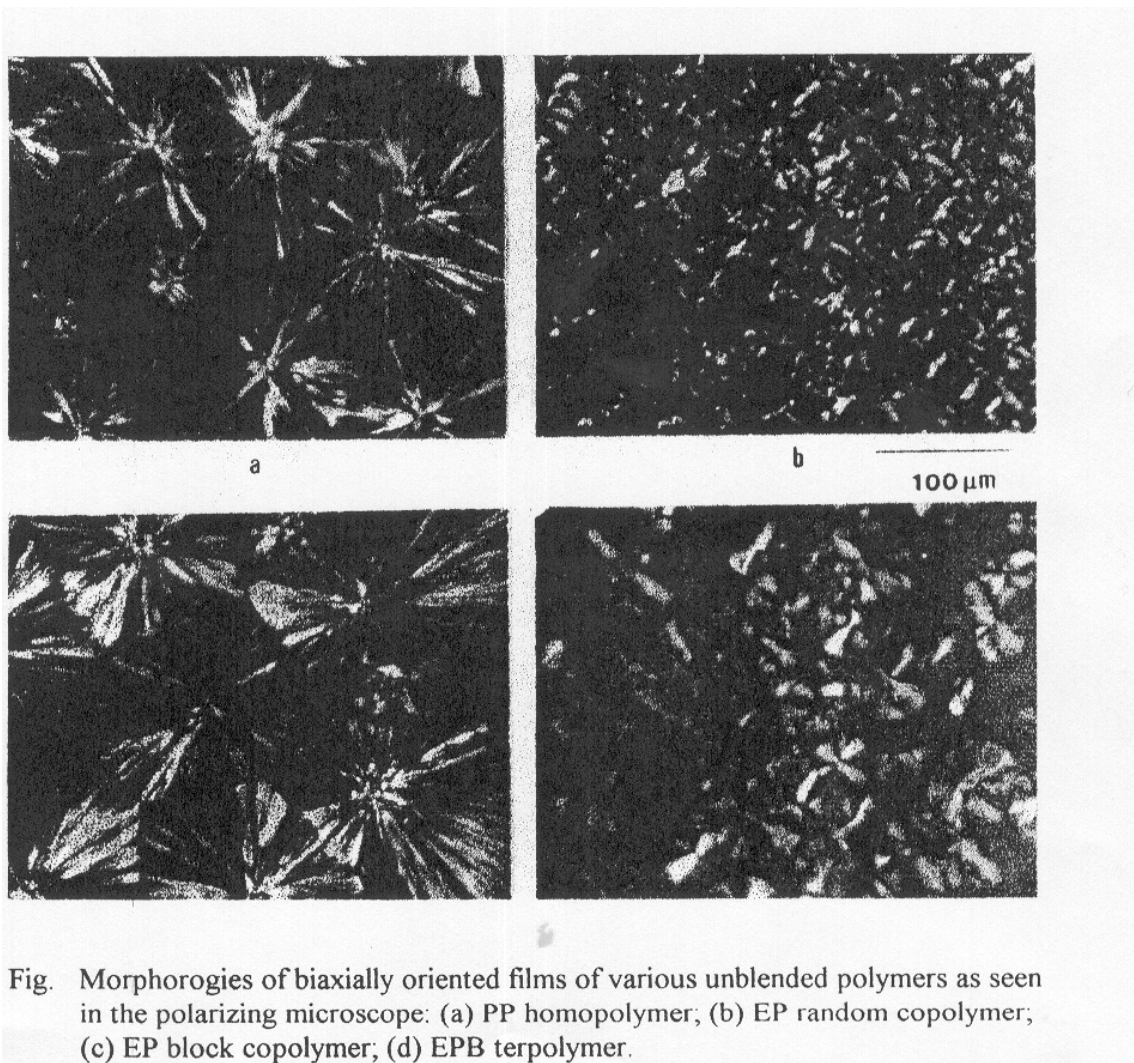


Fig. Morphologies of biaxially oriented films of various unblended polymers as seen in the polarizing microscope: (a) PP homopolymer; (b) EP random copolymer; (c) EP block copolymer; (d) EPB terpolymer.

VIII. LCP Based Polymer Blends

- Vectra-PET Blends(ref.16)

LCP:

Hoechst-Celanese Vectra A900: 73 mol% HBA and 27 mol% HNA

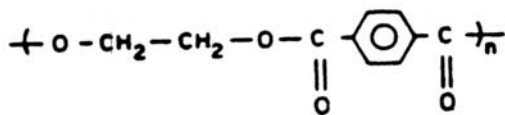


Poly(HBA/HNA)

$$x = 73, y = 27$$

$$DP \approx 110$$

$$M_n \approx 15,000$$



PET

$$DP = 110$$

$$M_n = 21,000$$

Liquid Crystal Region

