REFERENCES

Birelry, A. W., and Heath, R. J. Plastics Materials: Properties and Applications. 2 nd ed. New York: Chapman and Hall, 1988.

Brandrup, J., and Immergut, E. H. Polymer Handbook. 3 rd ed. New York: John Wiley & Sons, 1989.

Buckley, A., Conciatori, A. B., and Calundann, G. W. U.S. Patent, 4,434,262 (1984).

Charrier, J-M. Polymer Materials and Processing. New York: Oxford University, 1991.

Cowie, J. M. G. Polymer: Chemistry & Physics of Modern Materials. 2nd ed. New York: Chapman and Hall, 1991.

Dubault, A., Casagrande, C., and Veyssie, M. Flexible polymers in nematic solvents: phase diagrams in dilute regime. Molecular Crystal Liquid Crystal. 72 (Letters) (1982): 189-194.

Dutta, D., et al. Polymer blends containing liquid crystals : A review. Polymer Engineering and Science. 30(17) (1990): 1005-1018.

Eisenberg, Adi. The glass state and the glass transition. Private Commuincation. Imperial College: 1993.

Fava, R. A., Method of Experiment Physics, Part B: Crystal Structure and Morphology. New York: Academic Press, 1980.

Flynn, J. H. Thermochim. Acta. 8 (1974): 69. cited in Brandrup, J., and Immergut, E. H. Polymer Handbook. 3 rd ed. New York: John Wiley & Sons, 1989.

Folkes, M.J., and Hope, P. S. Polymer Blends and Alloys. London: Chapman & Hall, 1993.

Gedde, U. W. Polymer Physics. London: Chapman & Hall, 1995.

Harper, C. A. Handbook of plastic and Elastomers. New York: McGraw-Hill, 1975.

Huh, W., and weiss, R. A. Thermal and rheological properties of blends of polystyrene and thermotropic liquid crystals. Polymer Engineering and Science. 23(14) (1983): 779-783.

Kronberg, B., Bassignana, I., and Patterson, D. Phase diagrams of liquid crystal + polymer systems. The Journal of Physical Chemistry. 82(15) (1978) : 1714-1719.

Kroschwitz, J. I. Concise Encyclopedia of Polymer Science and Engineering. 2nd ed. New York: John Wiley & Sons, 1990.

Merck. Licrystal® Catalog. 1985.

Merck. Information of Licrystal®. 1996.

Oiarzabal, L. The glass transition phenomenon. Private Communication. Imperial College: 1993.

Olabisi, O., Robeson, L. M., and Shaw, M. T. Polymer-Polymer Miscibility. San Diego: Academic Press, 1979.

Organ, S. J., and Barham, P. J. Phase separation in a blend of poly(hydroxybutyrate) with poly(hydroxybutyrate-co-hydroxyvalerate). Polymer. 3(34) (1993): 459-467.

Patwardhan, A. A., and Belfiore, L. A. Thermodynamic miscibility of polymer-liquid crystal blends. Polymer Engineering and Science. 28(14) (1988): 916-925.

Paul, D. R., and Newman, S. Polymer Blends (Volume 1). New York: Academic Press, 1978.

Peyser, P., and Bascom, W. D. J. Macromol. Sci-Phys. B13(4) (1977): 597-610. cited in Brandrup, J., and Immergut, E. H. Polymer Handbook. 3 rd ed. New York: John Wiley & Sons, 1989.

Richardson, M. J., and Savill, N. G. Polymer. 16(1975): 753. cited in Brandrup, J., and Immergut, E. H. Polymer Handbook. 3 rd ed. New York: John Wiley & Sons, 1989.

Sperling, L. H. Introduction to Physical Polymer Science. 2 nd ed. New York: John Wiley & Sons, 1992.

Thongyai, S. Determination of Polymer Miscibility by Calorimetry (First Year Report). Doctoral Dissertation, Department of Chemical Engineering, Imperial College, 1990.

Walsh, D. J., Higgins, J. S., and Maconnachie, A. Polymer Blends and Mixtures. Dordrecht: Martinus Nijhoff, 1985.

Utracki, L. A. Polymer Alloys and Blends. New York: Hanser, 1989.

Woodward, A. E. Understanding Polymer Morphology. New York: Hanser, 1995.

APPENDIX

(Supportive Evidence for Gradient Method Criteria)

There are many theories to predict the T_g of a miscible blend. One of the most well known theories is the Flory-Fox equation [Paul and Newman, 1978] as shown belows:

$$\frac{1}{T_g} = \frac{W_1}{T_{g,1}} + \frac{W_2}{T_{g,2}}$$

where T_g = glass transition temperature of the mixture

W_i = weight fraction of the *i*th component

$T_{g,i}$ = glass transition temperature of the *i*th component

The gradient method was created to construct the phase diagram in this study. In this section, the criteria used for determining the phase behaviour of the blends from gradient value of the gradient method were used to determine the T_g of the blends as predicted from Flory-Fox equation.

The T_g of the blends of poly(bisphenol A carblnate) (PC) and low molar mass liquid crystal were calculated by Flory-Fox equation. The T_g of pure PC is 150°C. The T_g of pure low molar mass liquid crystal is assumed to be 25°C. (In reality, the T_g of pure low molar mass liquid crystal can not be detected even started DSC scan at -150°C.)

Let 1 = low molar mass liquid crystal (LC)

2 = PC

$T_{g,1}$ = 25°C or 298K

$T_{g,2}$ = 150°C or 423K

T_g = glass transition temperature of the blend

Flory-Fox equation: $$\frac{1}{T_g} = \frac{W_1}{298} + \frac{W_2}{423}$$

The plot of T_g versus LC weight percent as calculated from Flory-Fox equation above is shown in Figure A-1.

The gradient values (tanθ) were calculated in the same way as described previously in section 5.2 (Phase Diagram Construction Procedure). The determination of the phase behaviour of the blends was based on the criteria represented in the Table 5-7.

The T_g of the blends of PC and low molar mass liquid crystal are presented in Table A-1. The gradient value (tanθ), θ (degree) and symbols of the regions are presented in Table A-2.

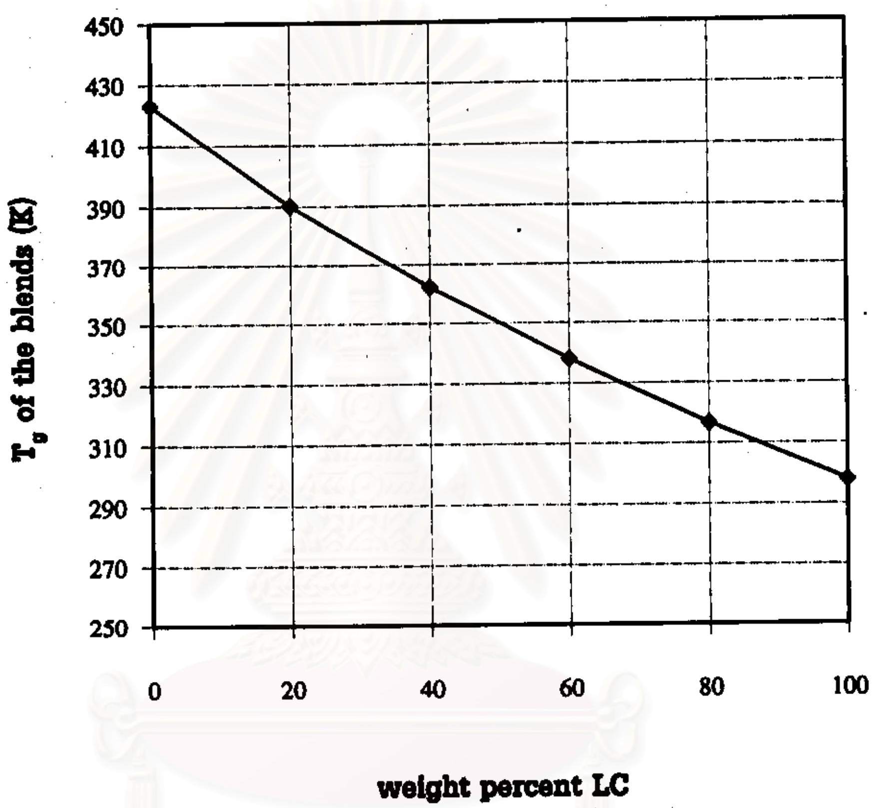

Figure A-1 The graph of the glass transition temperatures (T_g) of the blends against the weight percent of low molar mass liquid crystal.

Table A-1 The T_g of the blends of PC and low molar mass liquid crystal predicted from Flory-Fox equation.

% by weight of LC with PC	T_g of the blends (Kelvin)
0	423.0
20	390.3
40	362.2
60	337.9
80	316.7
100	298.0

Table A-2 Gradient value (tanθ) and θ (degree) calculated from the T_g of the blends of PC and low molar mass liquid crystal predicted from Flory-Fox equation in Table A-1. o represents the absolutely partially miscible. + represents the possibly partially miscible.

% by weight of LC with PC	gradient value (tanθ)	θ (degree)	region symbols
0-20	-1.637	-58.58	o
20-40	-1.402	-54.50	o
40-60	-1.214	-50.52	o
60-80	-1.061	-46.71	o
80-100	-0.936	-43.10	+

Flory-Fox equation is the equation that estimates the T_g of the miscible blend. The T_g of the blends (PC and low molar mass liquid crystal) presented in Table A-1 are calculated from Flory-Fox equation. It means that the blend (PC and low molar mass liquid crystal) is assumed to be the miscible blend. From above reason, if we use the T_g in Table A-1 to calculate the gradient value and determine the phase behaviour based on the criteria of the gradient method, it should show the miscible characteristics.

From Table A-2, it can be seen that the phase behaviour determined base on the criteria of the gradient method is the partially miscible blend. This is consistent with the fact described in above paragraph. So it can be concluded that the criteria of the gradient method is suitable for determining the phase behaviour of the blends in this study.

VITA

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