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APPENDIX A

Origin of multiple peak of PTT

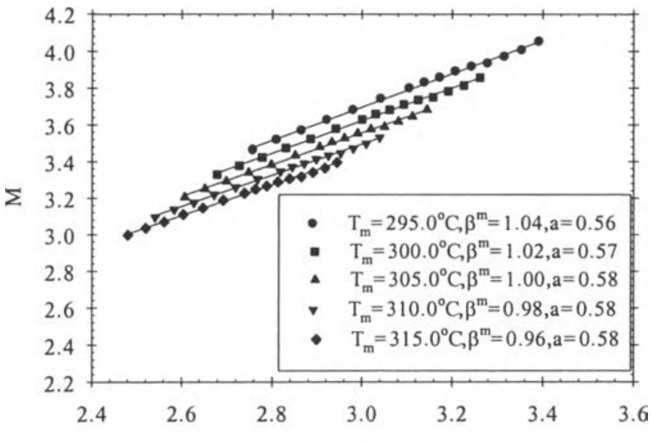

Figure A1 Plots of the scaled observed melting temerature [$M = T_m°/(T_m° - T_m)$] versus the scaled crystallization temperature [$X = T_m°/(T_m° - T_c)$] for various choices of the seeded equilibrium melting temperature ($T_m°$) of PTT ($T_m - T_c$ data 188 to 215°C).

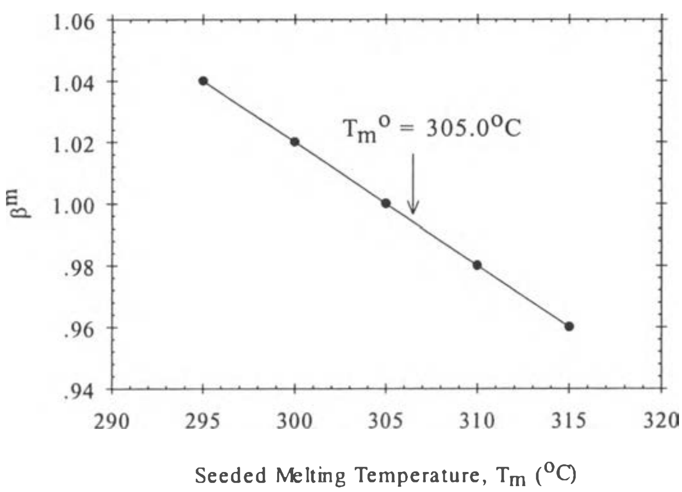

Figure A2 The variation of the thickening coefficient (β^m) as a function of the seeded equilibrium melting temperature ($T_m - T_c$ data 188 to 215°C).

APPENDIX B

Calculation in capillary rheometer

The load on the plunger and the plunger speed were converted into apparent shear stress and shear rate at the wall respectively by using the following equations involving the geometry of the capillary and the barrel:

$$\tau_w = \frac{FD_c}{4A_p L_c} \quad \text{(b1)}$$

where τ_w is apparent shear stress at the wall; F is the force acting on the plunger; A_p is cross sectional area of the plunger; D_c is diameter of the capillary die; L_c is length of the capillary die:

$$\dot{\gamma}_w = \frac{2V_p D_p^{\,2}}{15 D_c^{\,3}} \quad \text{(b2)}$$

where $\dot{\gamma}_w$ is apparent rate at wall; V_p is plunger speed; D_b is barrel diameter

$$\eta_a = \frac{\tau_w}{\dot{\gamma}_w} \quad \text{(b3)}$$

where η_a is apparent viscosity

The true shear rate was determined by using the Rabinowitch correction,

$$\dot{\gamma} = \frac{3n+1}{4n} \cdot \dot{\gamma}_w \quad \text{(b4)}$$

where $\dot{\gamma}_{tr}$ is true shear rate; n is Power law index. The value of n is the slope of the plot of log τ_w versus log $\dot{\gamma}_w$.

In this study, the Bagley correction was not necessary because the L/D ratio was 40.15, which was significantly long to neglect end effect.

APPENDIX C

Melting behavior of PTT

Table C1 Melting Behavior of PTT S0 after isothermal crystallization at 200°C recorded at a heating rate of 20°C·min^{-1}. Blank is as prepared film recorded at a same heating rate

T_f °C	$T_{onset,1}$ °C	$T_{peak,1}$ °C	$\Delta H_{f,1}$ J·g^{-1}	$T_{peak,2}$ °C	$\Delta H_{f,2}$ J·g^{-1}
Blank	218.3	-	-	226.3	56.0
265	216.0	219.1	26.2	228.3	27.3
270	216.2	218.6	22.2	227.7	28.0
275	216.1	219.0	24.3	228.4	27.7
280	216.1	218.4	15.8	227.7	28.7
285	215.9	218.4	23.2	228.1	29.9
290	215.9	218.2	17.4	227.7	31.2
300	215.4	217.7	16.7	227.4	35.0

Table C2 Melting Behabvior of PTT S92.1 after isothermal crystallization at 200°C recorded at a heating rate of 20°C·min^{-1}

T_f °C	$T_{onset,1}$ °C	$T_{peak,1}$ °C	$\Delta H_{f,1}$ J·g^{-1}	$T_{peak,2}$ °C	$\Delta H_{f,2}$ J·g^{-1}
265	216.0	220.0	25.8	229.3	30.2
270	215.9	219.4	20.6	229.0	29.3
275	215.7	219.7	28.0	229.0	29.7
280	215.5	216.0	15.9	227.7	31.2
285	215.3	219.8	27.2	228.7	31.6
290	215.0	215.6	17.2	228.0	33.0
300	214.8	218.5	25.8	228.7	35.1

Table C3 Melting Behavior of PTT S245.6 after isothermal crystallization at 200°C recorded at a heating rate of 20°C·min^{-1}

T_f °C	$T_{onset,1}$ °C	$T_{peak,1}$ °C	$\Delta H_{f,1}$ J·g^{-1}	$T_{peak,2}$ °C	$\Delta H_{f,2}$ J·g^{-1}
265	216.9	220.0	22.1	230.0	30.8
270	216.0	219.8	22.3	230.0	31.4
275	215.7	219.1	22.5	229.0	30.2
280	216.0	219.4	23.7	229.3	30.2
285	215.3	218.9	23.6	228.7	30.3
290	215.2	218.6	23.5	228.7	31.1
300	214.4	218.3	21.0	228.7	32.5

APPENDIX D

Crystallization behavior of PTT crystallized from glassy state

Table D1 Crystallization and melting behavior of PTT shear untreated and shear treated samples at shearing temperature = 250°C (first heating scan)

Shear rate s^{-1}	T_g °C	$T_{cc,onset}$	T_{cc}	$\Delta H_c(-)$ $J{\cdot}g^{-1}$	$T_{m,onset}$	T_m	$\Delta H_f(+)$
0	44.0	71.5	74.3	27.9	218.1	227.3	59.9
5t1	43.7	67.0	73.0	26.1	217.0	227.7	61.4
5t3	42.9/50.3	68.4	73.0	24.9	217.0	227.7	63.3
5t5	45.8/50.6	69.4	73.3	25.8	218.5	229.0	59.9
10t1	42.8/48.7	67.4	72.0	24.8	218.5	228.3	61.6
10t3	42.9/51.6	65.8	70.7	24.4	219.3	229.0	61.7
10t5	42.4	65.9	70.0	24.9	216.9	228.0	62.8
53.2	43.1	67.4	70.7	27.8	218.3	228.0	60.8
62.7	49.0	67.5	70.7	28.5	216.3	227.3	62.6
66.5	47.8	68.0	71.0	27.7	217.8	228.3	57.3
84.9	50.9	68.6	72.0	28.2	216.9	227.0	57.9
92.1	46.5	65.3	68.3	28.1	216.6	228.0	60.7
94.0	48.9	67.2	70.3	28.3	216.0	226.7	62.1
99.8	47.3	67.6	70.7	27.6	218.3	228.0	59.9
133.0	41.7	66.3	69.3	28.0	218.2	228.0	60.7
245.6	44.7/53.6	65.3	68.3	28.9	217.8	227.7	64.0
250.6	46.2	66.3	69.3	28.1	217.5	227.3	62.7
429.9	45.9	65.9	69.0	28.6	217.8	226.7	64.0
438.6	42.3	66.7	69.7	26.6	217.1	226.7	62.7

Table D2 Crystallization and melting behavior of PTT shear untreated and shear treated samples at shearing temperature = 250°C (second heating scan)

Shear rate s^{-1}	T_g °C	$T_{cc,onset}$ °C	T_{cc} °C	$\Delta H_c(-)$ $J{\cdot}g^{-1}$	$T_{m,onset}$ °C	T_m °C	$\Delta H_f(+)$ $J{\cdot}g^{-1}$
5t1	43.5	71.0	74.3	29.4	217.8	227.0	60.9
5t3	45.2	71.4	74.3	28.9	217.2	227.7	61.2
5t5	42.6	71.0	74.3	28.7	216.7	227.3	61.2
10t1	46.0	71.8	75.0	28.1	216.7	227.7	60.4
10t3	45.3	71.3	74.3	29.2	216.9	227.3	62.1
10t5	46.3	71.7	75.0	28.4	217.0	227.7	61.6
53.2	45.5	71.0	74.0	28.7	217.6	227.3	60.8
66.5	45.1	69.5	73.3	28.4	217.5	227.3	58.2
84.9	44.7	71.2	74.3	28.8	216.0	227.3	60.3
92.1	45.4	71.7	74.7	27.5	216.5	227.7	58.9
99.8	47.1	71.5	74.3	27.9	217.5	227.7	58.5
133.0	45.8	71.6	74.7	28.4	217.5	228.0	59.1
245.6	52.2	71.4	74.3	25.2	219.0	228.3	60.7
250.6	44.9	70.8	73.7	28.6	217.4	227.0	62.2
429.9	45.6	71.1	74.3	28.4	216.5	227.0	60.4
438.6	43.7	70.0	73.0	28.5	216.8	226.7	62.6

Table D3 Crystallization and melting behavior of PTT shear untreated and shear treated samples at shearing temperature = 260°C (first heating scan)

Shear rate s^{-1}	T_g °C	$T_{cc,onset}$ °C	T_{cc} °C	$\Delta H_c(-)$ $J{\cdot}g^{-1}$	$T_{m,onset}$ °C	T_m °C	$\Delta H_f(+)$ $J{\cdot}g^{-1}$
0	45.6	71.2	74.3	29.1	216.1	226.7	62.5
70.6	48.2	67.2	70.0	29.2	217.9	228.3	62.7
105.9	43.8	66.8	69.7	29.8	218.0	228.3	63.0
141.2	50.8	68.5	71.3	28.6	216.7	227.7	62.7
211.9	50.4	68.4	71.3	28.6	217.2	228.0	64.3
268.0	49.6	67.8	70.7	28.9	216.0	227.0	63.2
469.0	51.0	68.6	71.7	29.2	216.2	227.3	64.9

Table D4 PTT samples at shear rate 0 s^{-1} melted at T_f 260°C for 5 min following by quenching in liquid nitrogen and heated at different heating rate

Heating Rate °C·min^{-1}	$T_{c\ onset}$ °C	$T_{c\ peak}$ °C	ΔH_c J·g^{-1}	$T_{m\ onset}$ °C	$T_{m\ peak}$ °C	ΔH_f J·g^{-1}
10	65.7	68.5	27.1	218.3	227.2	61.2
20	71.5	74.3	28.0	218.0	227.3	61.6
30	72.1	75.5	30.7	216.2	226.5	64.0
40	73.5	77.0	32.8	215.4	225.7	64.3

Table D5 PTT samples at shear rate 92.1 s^{-1} melted at T_f 260°C for 5 min following by quenching in liquid nitrogen and heated at different heating rate

Heating Rate °C·min^{-1}	$T_{c\ onset}$ °C	$T_{c\ peak}$ °C	ΔH_c J·g^{-1}	$T_{m\ onset}$ °C	$T_{m\ peak}$ °C	ΔH_f J·g^{-1}
10	60.6	63.5	26.8	218.9	228.0	62.9
20	65.3	68.7	28.6	216.6	228.0	61.7
30	66.3	70.0	29.6	216.3	227.5	63.5
40	68.8	72.3	30.1	216.0	227.7	62.0

Table D6 PTT samples at shear rate 245.6 s^{-1} melted at T_f 260°C for 5 min following by quenching in liquid nitrogen and heated at different heating rate

Heating Rate °C·min^{-1}	$T_{c\ onset}$ °C	$T_{c\ peak}$ °C	ΔH_c J·g^{-1}	$T_{m\ onset}$ °C	$T_{m\ peak}$ °C	ΔH_f J·g^{-1}
10	61.0	63.8	30.4	217.9	227.3	69.3
20	65.2	68.3	28.9	215.0	227.7	64.0
30	63.3	70.8	25.0	216.9	227.0	62.1
40	69.7	73.0	30.6	215.8	228.3	60.7

APPENDIX E

Crystallization behavior of PTT crystallized from melt state

Table E1 PTT samples at shear rate 0 s^{-1} melted at T_f 260°C for 5 min

Cooling Rate °C·min^{-1}	T_{onset} °C	T_{peak} °C	ΔH_c J·g^{-1}
10	194.7	184.5	51.6
20	189.5	176.6	50.4
30	182.1	167.4	49.9
40	181.9	167.9	48.9

Table E2 PTT samples at shear rate 92.1 s^{-1} melted at T_f 260°C for 5 min

Cooling Rate °C·min^{-1}	T_{onset} °C	T_{peak} °C	ΔH_c J·g^{-1}
10	201.3	193.0	56.2
20	196.7	184.9	54.4
30	192.9	180.5	54.3
40	189.9	177.9	53.4

Table E3 PTT samples at shear rate 245.6 s^{-1} melted at T_f 260°C for 5 min

Cooling Rate °C·min^{-1}	T_{onset} °C	T_{peak} °C	ΔH_c J·g^{-1}
10	200.2	194.1	58.7
20	197.8	189.9	55.2
30	194.5	184.5	52.8
40	192.0	180.6	53.3

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