EXP6:Phase Diagram of a Binary Solid-Liquid System

1. 繪製溫度對時間以獲得相應的熔點或破裂溫度（混合物的第一熔點）。

T(℃) VS T(sec) 6 張圖→T_f

2. 將重量百分比組合物轉化成摩爾分率。

$X_p = n_p/n_p+n_bX_b = n_b /n_a +n_b$

3. 根據整體組成（聯苯的摩爾分數）繪製斷裂和停止溫度。繪製共晶線和液相線曲線以獲得共晶組成和溫度。標記所有字段以顯示出現的階段。

X_b							
lnX_b							
X_p							
lnX_p							
T(K)							
1/T(K)							

lnX_b VS 1/T(K)作圖及 lnXp VS 1/T(K) 作圖 2 張

4. 使用摩爾分率和冰點的實驗數據，用對二氯苯和聯苯的摩爾分率的對數作為縱坐標和絕對溫度的倒數作為橫坐標。在純對二氯苯和聯苯的熔點處獲得曲線的斜率，並使用方程式計算每種組分的平均摩爾熔化熱。

lnX = - △Hm/R ・1/T +C

slope = △Hm/RR= 8.314J/molK

△Hm = ?

Mole fraction of biphenyl							
凝固點溫度(℃)							

Mole fraction of biphenyl VS 凝固點溫度(℃)作圖

Exp.6

$M_{biphenyl}$	154.21	g/mol		T_{room}	28.3	°C
$M_{C_6H_4Cl_2}$	147.00	g/mol		P_{room}	747.3	mmHg

W% of biphenyl	0	15	30	45	60	80	100
W of biphenyl	0	0.300	0.609	0.898	1.208	1.605	2.002
W of $C_6H_4Cl_2$	2.046	1.709	1.398	1.104	0.795	0.400	0
mole of biphenyl	0.000	0.002	0.004	0.006	0.008	0.010	0.013
mole of $C_6H_4Cl_2$	0.014	0.012	0.010	0.008	0.005	0.003	0.000
total mole	0.014	0.014	0.013	0.013	0.013	0.013	0.013

冷卻曲線

0% of biphenyl		15% of biphenyl		30% of biphenyl		45% of biphenyl		60% of biphenyl		80% of biphenyl		100% of biphenyl	
time (s)	溫度 (℃)	time (s)	溫度 (℃)	time (s)	溫度 (℃)	time (s)	溫度 (℃)	time (s)	溫度 (℃)	time (s)	溫度 (℃)	time (s)	溫度 (℃)
0	71.0	0	67.0	0	55.0	0	48.0	0	55.0	0	74.0	0	86.0
10	68.3	10	63.2	10	53.0	10	46.5	10	53.2	10	71.2	10	82.8
20	66.2	20	60.9	20	51.5	20	45.5	20	52.0	20	69.0	20	80.2
30	64.7	30	59.0	30	50.5	30	44.6	30	50.0	30	66.8	30	78.0
40	62.8	40	57.8	40	49.0	40	43.5	40	48.9	40	64.8	40	76.1
50	61.2	50	56.6	50	47.7	50	43.7	50	47.8	50	62.5	50	74.5
60	59.9	60	55.2	60	45.8	60	41.8	60	46.7	60	61.8	60	73.2
70	58.8	70	54.0	70	44.3	70	41.0	70	45.8	70	59.5	70	72.0
80	57.5	80	52.8	80	43.0	80	40.1	80	44.9	80	58.3	80	70.8
90	56.4	90	51.2	90	41.6	90	39.0	90	44.0	90	57.1	90	69.6
100	55.5	100	50.1	100	40.5	100	37.9	100	43.0	100	56.2	100	68.8
110	54.5	110	49.0	110	39.5	110	37.0	110	42.3	110	55.6	110	68.0
120	53.4	120	48.0	120	38.6	120	36.0	120	41.4	120	55.1	120	67.3
130	52.8	130	47.0	130	37.3	130	35.1	130	41.0	130	55.0	130	67.0
140	52.0	140	46.0	140	36.7	140	34.5	140	40.0	140	54.5	140	66.9
150	51.9	150	45.0	150	36.0	150	33.8	150	39.5	150	54.5	150	66.7
160	51.8	160	44.0	160	35.0	160	32.9	160	38.9	160	54.3	160	66.5
170	51.6	170	43.8	170	34.6	170	32.0	170	38.3	170	54.0	170	66.3
180	51.6	180	43.8	180	34.3	180	31.6	180	38.3	180	53.9	180	66.2
190	51.6	190	43.6	190	34.2	190	30.8	190	38.3	190	53.7	190	66.0
200	51.5	200	43.2	200	34.1	200	30.0	200	38.3	200	53.3	200	66.0
210	51.5	210	43.1	210	34.0	210	29.7	210	38.3	210	53.0	210	66.0
220	51.5	220	43.0	220	33.9	220	29.3	220	38.1	220	53.0	220	66.0
230	51.5	230	43.0	230	33.6	230	29.0	230	38.0	230	52.8	230	66.0
240	51.4	240	42.9	240	33.4	240	28.5	240	37.9	240	52.6	240	66.0
250	51.4	250	42.8	250	33.2	250	27.9	250	37.5	250	52.2	250	66.0
260	51.2	260	42.2	260	33.0	260	27.6	260	37.1	260	52.0	260	66.0
270	51.2	270	42.1	270	32.8	270	27.1	270	37.0	270	51.6	270	66.0
280	51.1	280	42.0	280	32.2	280	26.9	280	36.8	280	51.3	280	66.0
290	51.1	290	41.7	290	32.0	290	26.2	290	36.2	290	51.2	290	65.8
300	51.1	300	41.6	300	31.8	300	25.9	300	36.0	300	51.0	300	65.7
310	51.1	310	41.4	310	31.4	310	25.5	310	35.9	310	50.9	310	65.6
320	51.0	320	41.2	320	31.0	320	25.0	320	35.0	320	50.5	320	65.4
330	51.0	330	41.0	330	30.6	330	24.9	330	35.2	330	50.1	330	65.2
340	51.0	340	40.8	340	30.4	340	24.8	340	35.0	340	50.0	340	65.0
350	51.0	350	40.4	350	30.0	350	24.2	350	34.8	350	49.8	350	64.8
360	51.0	360	40.2	360	30.0	360	24.0	360	34.6			360	64.8
370	51.0	370	40.0	370	29.8	370	24.0	370	34.1			370	64.5
380	51.0	380	40.2			380	24.0	380	33.9			380	64.3
390	51.0	390	39.8			390	24.1	390	33.8			390	64.1
400	51.0	400	39.4			400	24.3	400	33.2			400	64.0
410	51.0	410	39.2			410	24.8					410	63.9
420	51.0	420	39.0			420	25.0						
430	51.0	430	38.8			430	25.2						
440	51.0	440	38.6			440	25.5						
450	51.0	450	38.6			450	25.6						
		460	38.2			460	25.8						
		470	38.0			470	25.8						
		480	38.0			480	25.8						
		490	37.8			490	25.9						
		500	37.6			500	25.9						
						510	26.0						
						520	26.0						
						530	26.0						
						540	26.0						
						550	26.0						
						560	26.0						

Calculation

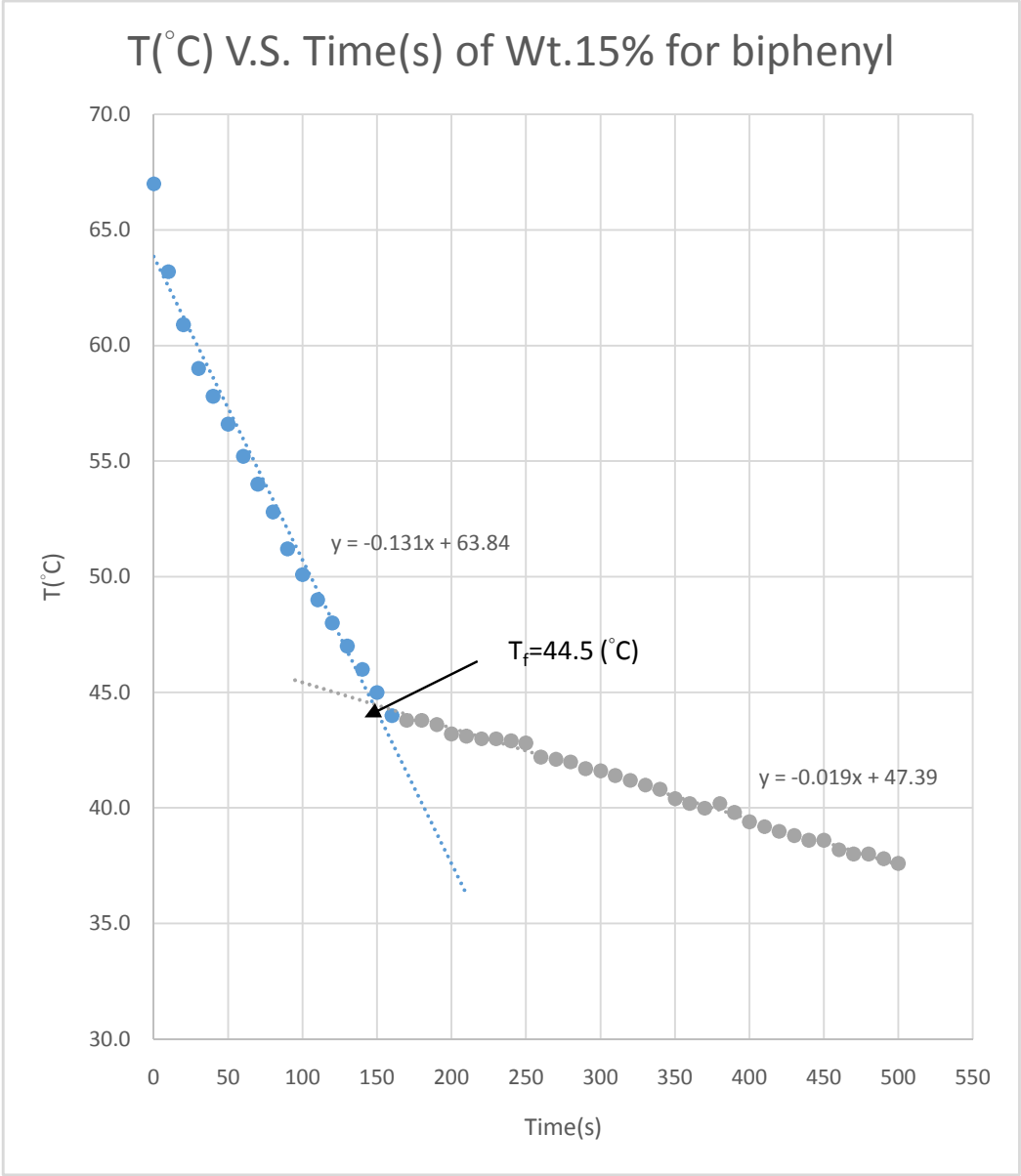
(1) 莫爾分率 (以 15% (W%) biphenyl 為例)

A：biphenyl　　B：p-dichlorobenzene

$M_{biphenyl}$	154.21g/mol
$M_{C_6H_4Cl_2}$	147.00g/mol

$$\chi_A = \frac{n_A}{n_A + n_B} = \frac{\frac{0.300\ g}{154.21\frac{g}{mol}}}{\frac{0.300g}{154.21\frac{g}{mol}} + \frac{1.709g}{147.00\frac{g}{mol}}} = 0.143$$

$$\chi_B = \frac{n_B}{n_A + n_B} = \frac{\frac{1.709g}{147.00\frac{g}{mol}}}{\frac{0.300g}{154.21\frac{g}{mol}} + \frac{1.709g}{147.00\frac{g}{mol}}} = 0.857$$



W% of biphenyl	0	15	30	45	60	80	100
$X_{biphenyl}$	0	0.143	0.293	0.437	0.592	0.793	1
$X_{C_6H_4Cl_2}$	1	0.857	0.707	0.563	0.408	0.207	0
$\ln X_{biphenyl}$		-1.942	-1.226	-0.828	-0.525	-0.232	0
$\ln X_{C_6H_4Cl_2}$	0	-0.155	-0.347	-0.574	-0.895	-1.574	
Tf	51.7	44.5	34.6	25.2	38.5	56.0	66.8
T(k=K)	324.90	317.64	307.79	298.33	311.65	329.15	339.95
1/T	0.00308	0.00315	0.00325	0.00335	0.00321	0.00304	0.00294

(2) ΔH calculate

ln(x)vs. 1/T

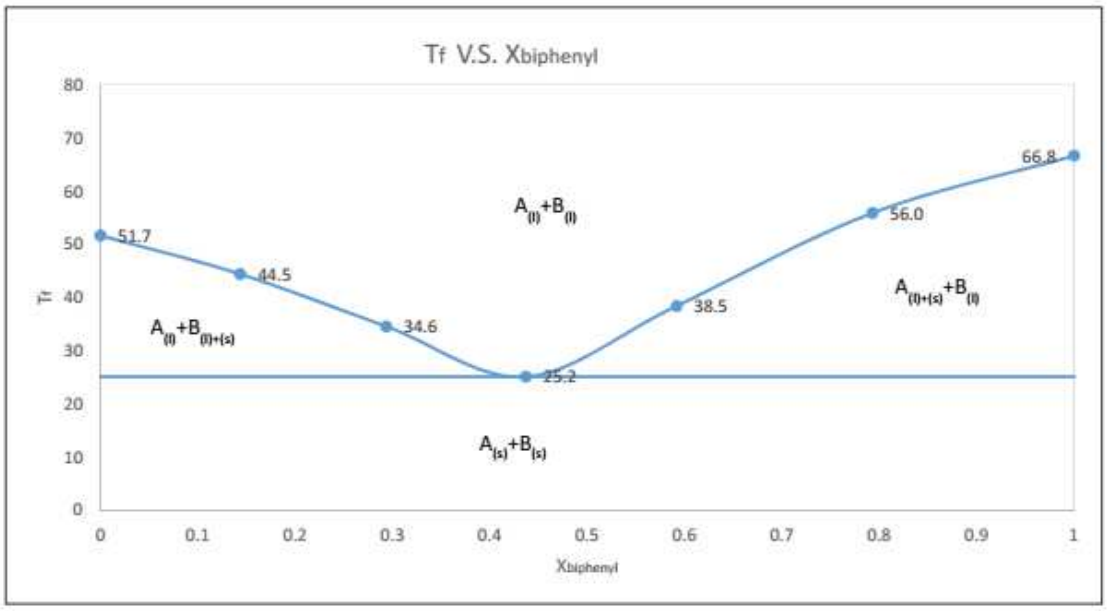
$$\text{slope} = \frac{d(\ln\ x)}{d(\frac{1}{T})} = -\frac{\Delta H}{R}$$

For biphenyl

$$\Delta\text{H} = -(-2073\text{K}) \times 8.3145 \frac{\text{J}}{\text{K} \times \text{mol}} = 17235\ (\frac{\text{J}}{\text{mol}})$$

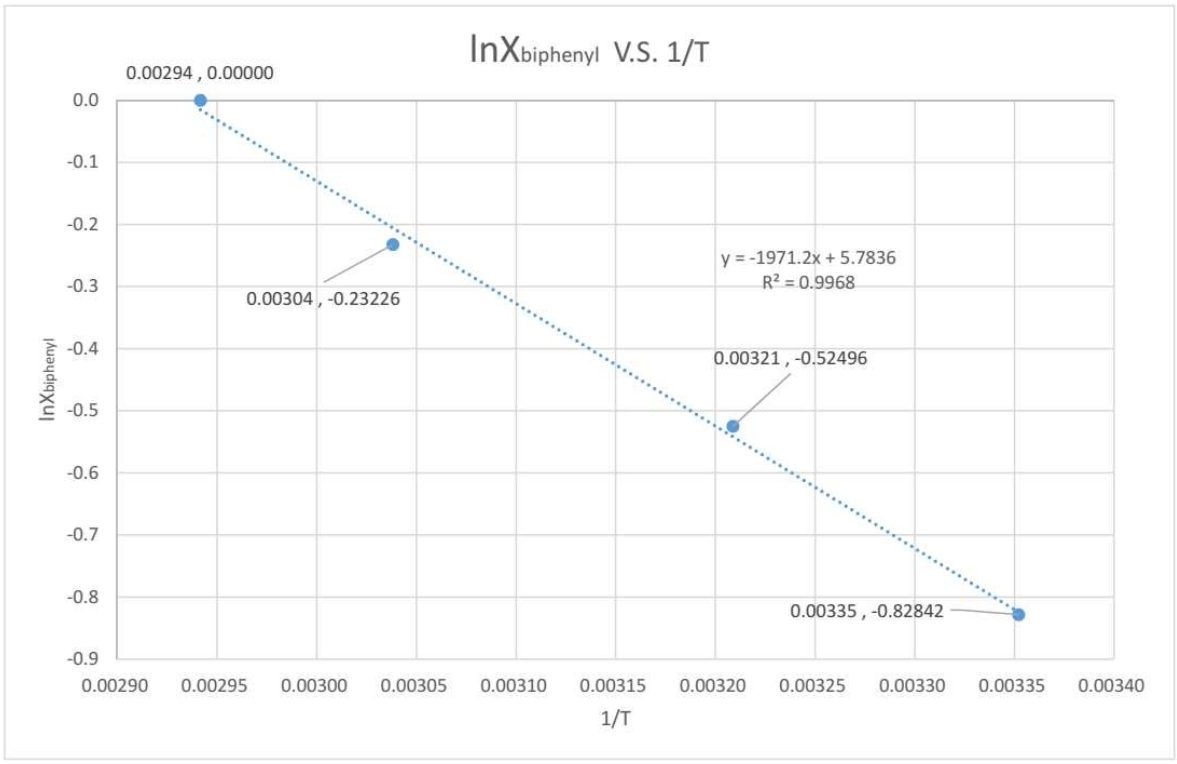
For p-dichlorobenzene

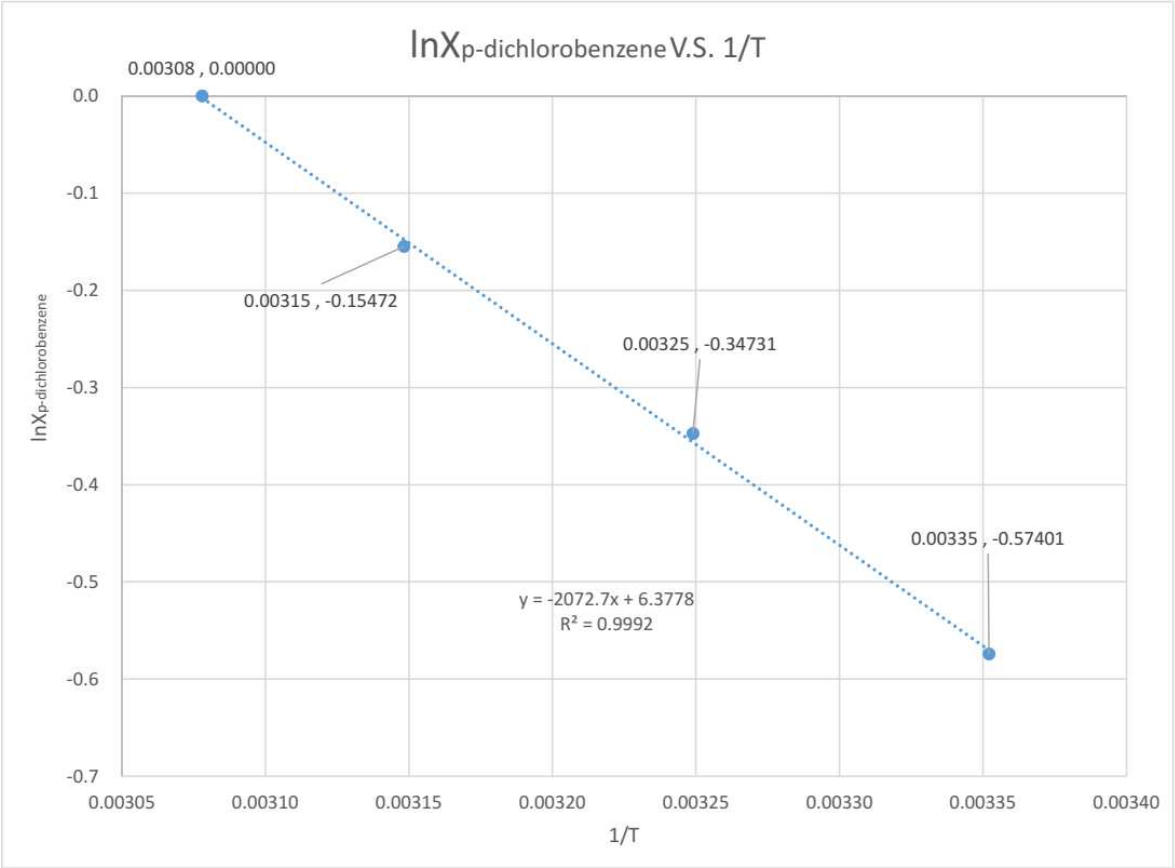
$$\Delta\text{H} = -(-2221.2\text{K}) \times 8.3145 \frac{\text{J}}{\text{K} \times \text{mol}} = 18468\ (\frac{\text{J}}{\text{mol}})$$



A=biphenyl

B=p-chlorobenzene


lnXbiphenyl V.S. 1/T
0.00294 , 0.00000
0.00304 , -0.23226
0.00321 , -0.52496
0.00335 , -0.82842
y = -1971.2x + 5.7836
R² = 0.9968
lnXbiphenyl
1/T
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
0.00290
0.00295
0.00300
0.00305
0.00310
0.00315
0.00320
0.00325
0.00330
0.00335
0.00340


lnXp-dichlorobenzene V.S. 1/T
0.00308 , 0.00000
0.00315 , -0.15472
0.00325 , -0.34731
0.00335 , -0.57401
y = -2072.7x + 6.3778
R² = 0.9992
lnXp-dichlorobenzene
1/T
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
0.00305
0.00310
0.00315
0.00320
0.00325
0.00330
0.00335
0.00340