Electronic Supplementary Information

Synthesis of Energetic Polynorbornene with Pendant Bis-Azidoacetyloxymethyl Groups (PNBAA)

Kun Jiang,[a] Han-Lin Deng, [a] Qi Zhang, [b] Shuifeng Wang, [c] Hao Wu, [a] Yan Liu,[a] Chunpeng Chai[a] and Mu-Hua Huang*[a]

[a.] School of Materials Science and Engineering, Beijing Institute of Technology
No. 5, Zhongguancun South Street, Beijing 100081, China
E-mail: mhhuang@bit.edu.cn

[b.] Institute of Chemical Materials, China Academy of Engineering Physics, Manyang 621900, Sichuan, China

[c.] Analytical and Testing Center, Beijing Normal University, Beijing Normal University,Beijing100875,China

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Table S1 : The optimization on solvent-free Diels-Alder reaction

Entry	n_{CPD}:n_{diol}	Temperature(℃)	Time(h)	Yield (%)
1	1:1	100	5	<10
2	1:1	150	5	<10
3	1:1	170	5	<20
4	1:1	190	5	45
5	**1:1**	**200**	**5**	**60**
6	1:1	250	5	55
7	1.05:1	200	5	55
8	1.2：1	200	5	40
9	2.5：1	200	5	41
10	1：1.2	200	5	50
11	1:1	200	1	<10
12	1:1	200	2	<10
13	1:1	200	3	30
14	1:1	200	4	50

Table S2 The comparison of 1H-NMR between 3 and reported data

norbornene diolreported by Paul R. Hanson (in $CDCl_3$)	Norbornene-dimethanol (3)(in $CDCl_3$)	△δ
6.02(H-1)	6.00(H-1)	0.02
4.07 (H-6)	4.33 (H-6)	0.26
3.61 (H-4)	3.59-3.56 (H-4)	0.02
3.39-3.30(H-5)	3.33 (H-5)	0.00
2.78 (H-2)	2.76 (H-2)	0.02
2.55-2.47(H-3)	2.50(H-3)	0.00
1.42-1.35(H-7)	1.34-1.40(H-7)	0.02
Ref: *J. Org. Chem.* **2007**, *72*, 3194-3198.		

Table S3 The comparison of ^{13}C-NMR between 3 and reported data

norbornene diolreported by Paul R. Hanson (in CDCl3)	Diels-Alder–norbornene diol(in CDCl3)	△δ
45.0 (C-c)	45.2 (C-c)	0.2
46.5 (C-b)	46.6 (C-b)	0.1
49.9 (C-e)	49.9 (C-e)	0.0
63.4 (C-d)	63.6 (C-d)	0.1
134.7 (C-a)	134.8 (C-a)	0.1
Ref: *J. Org. Chem.* **2007**, *72*, 3194-3198.		

Table S4 Elemental analysis on NBCA, PNBCA and PNBAA

Sample	**Mass Percentage (%)**					
	Found			**Theoretical [a]**		
	N	**C**	**H**	**N**	**C**	**H**
NBCA	0	51.04	5.49	0	50.83	5.25
PNBCA	0	50.14	5.30	0	50.83	5.25
PNBAA	24.10	48.90	5.27	26.24	48.75	5.04

[a] Theoretical values were calculated assuming an ideal structure of PNBCA for the elemental analysis.

Table S5 ICP-Ms analysis on PNBCA for Ru content

PNBCA[a]	Ru Content (ppm)
First -precipitating[b]	966
Second -precipitating[b]	823
Third -precipitating[b]	790

[a] PNBCA was synthesis through solvent free way with 1 mol% of Grubbs' I catalyst. [b] 500 mg PNBCA was dissolve in 5 ml 3-pentone and added 5 ml methanol to precipitate.

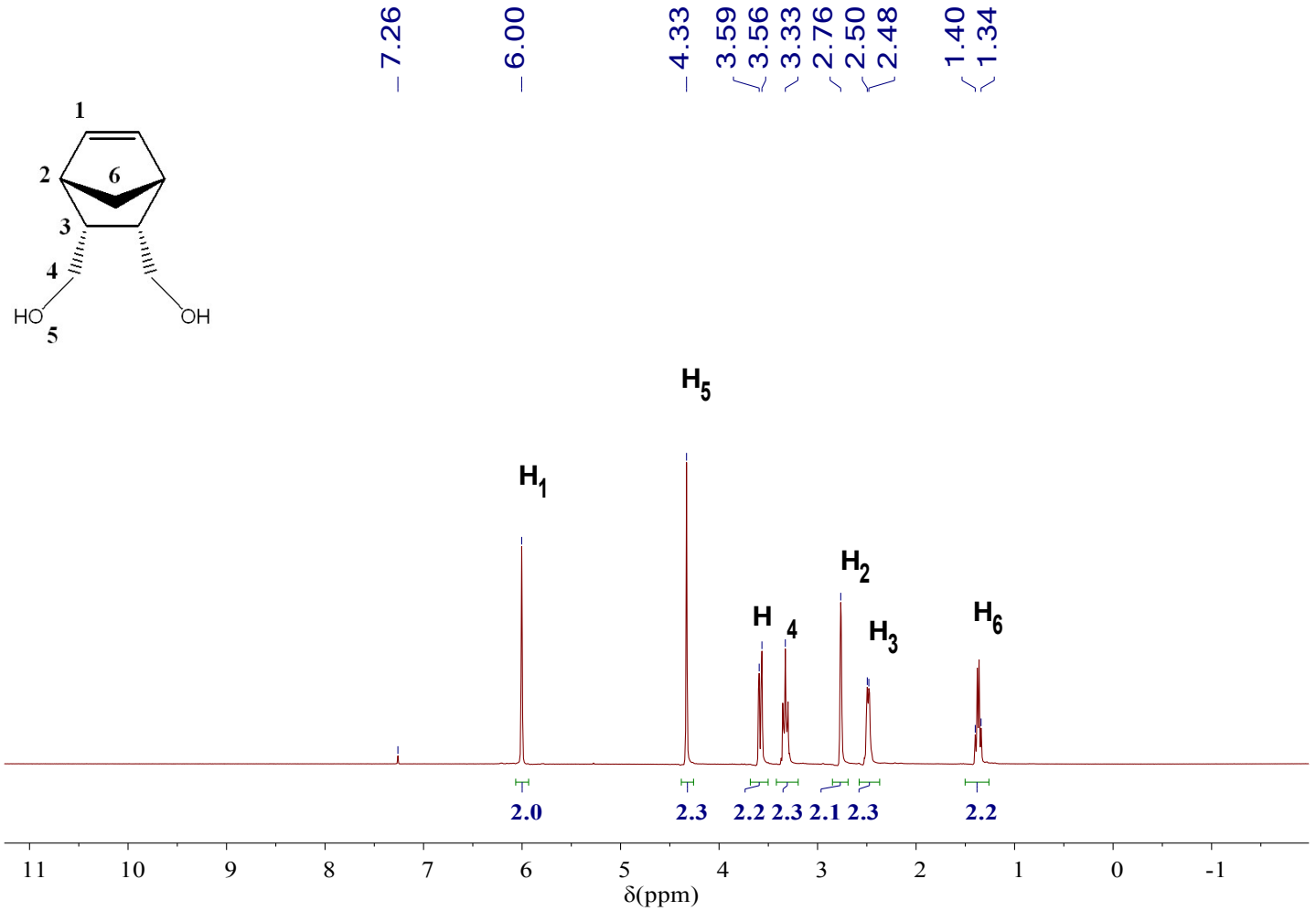

Figure S1 : The ^{1}H-NMR spectrum of norbornene-dimethanol (3) in $CDCl_3$

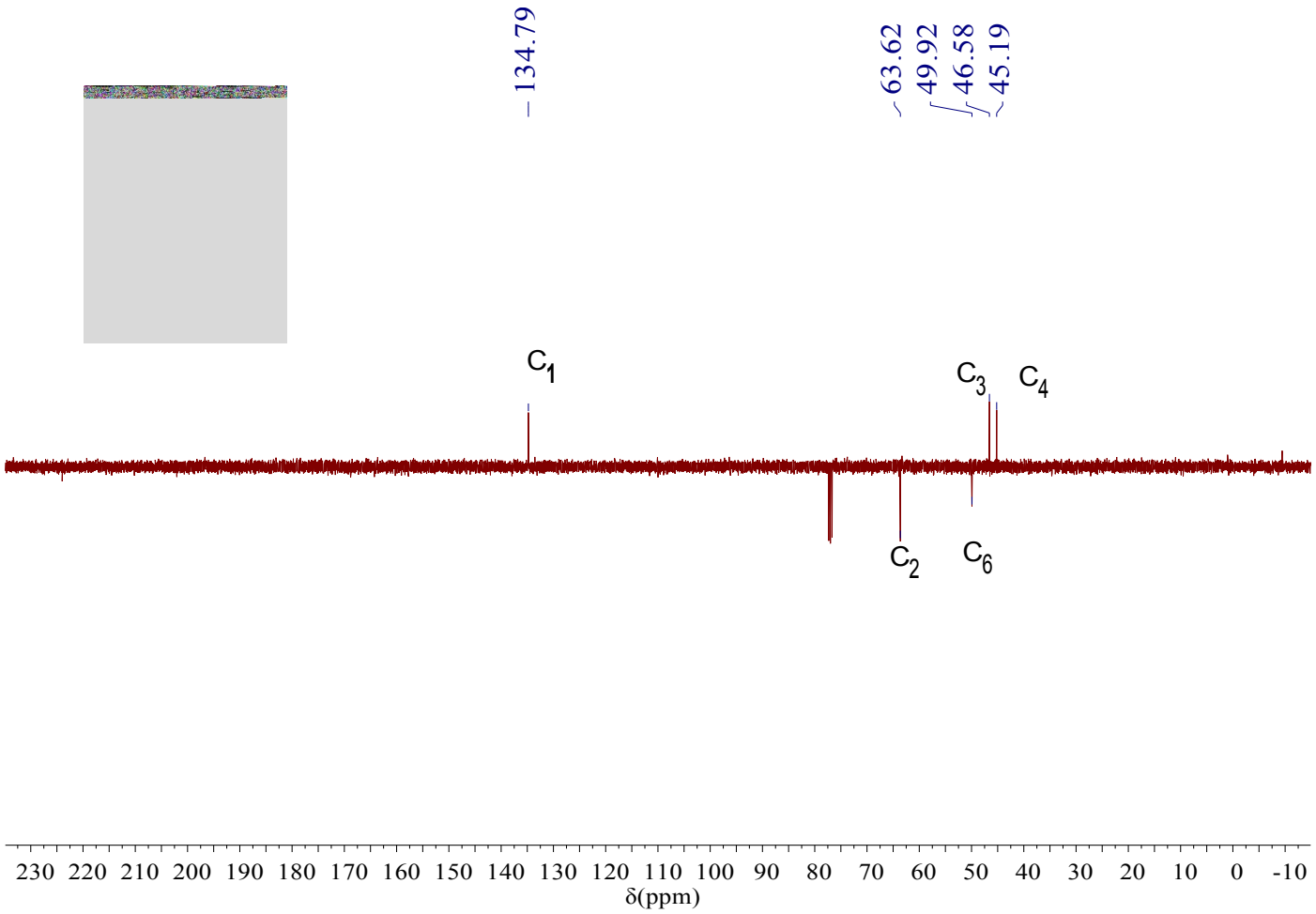

Figure S2 : The ^{13}C-NMR spectrum of norbornene-dimethanol (3) in $CDCl_3$

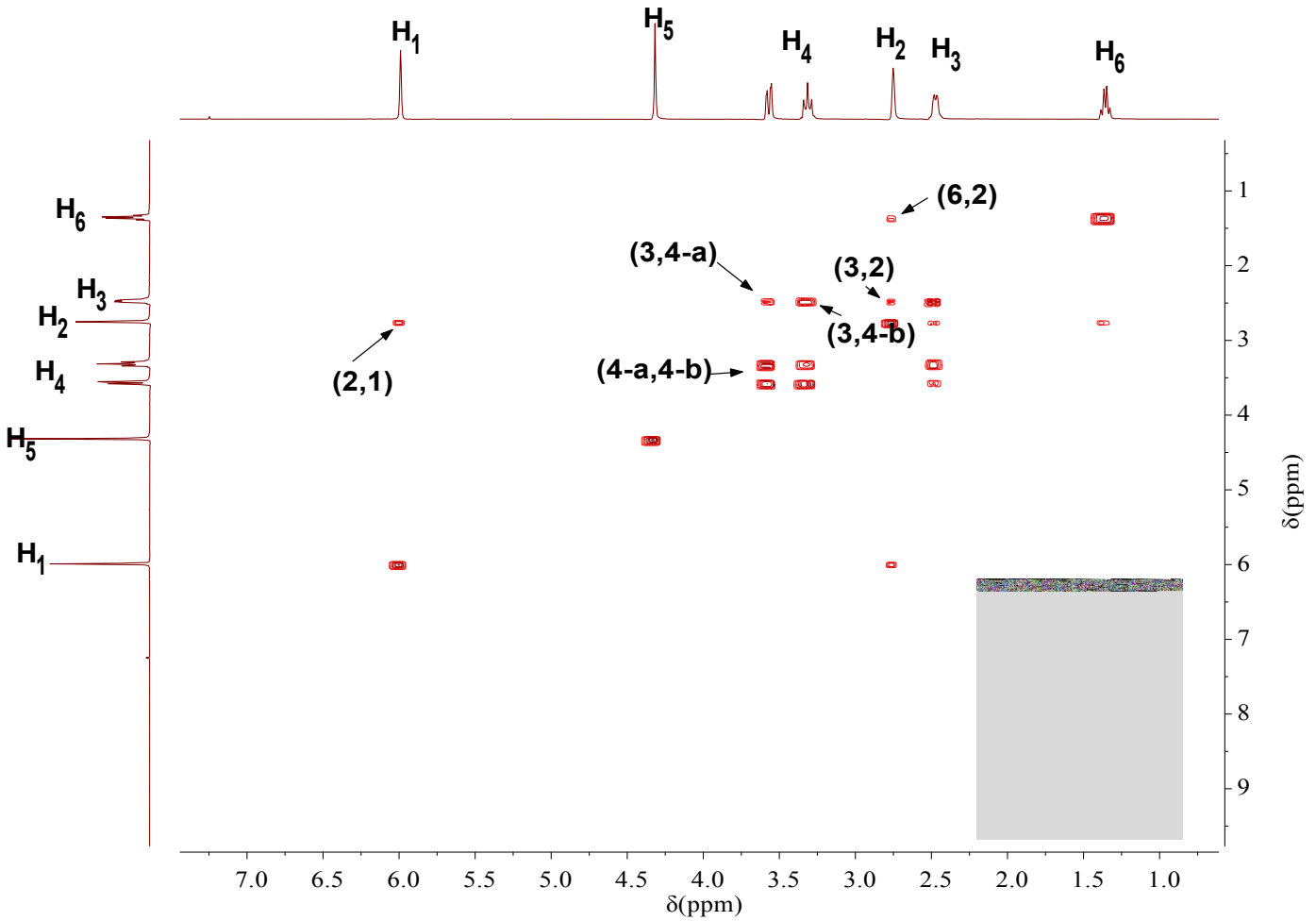

Figure S3 : The gCOSY-NMR spectrum of norbornene-dimethanol (3) in $CDCl_3$

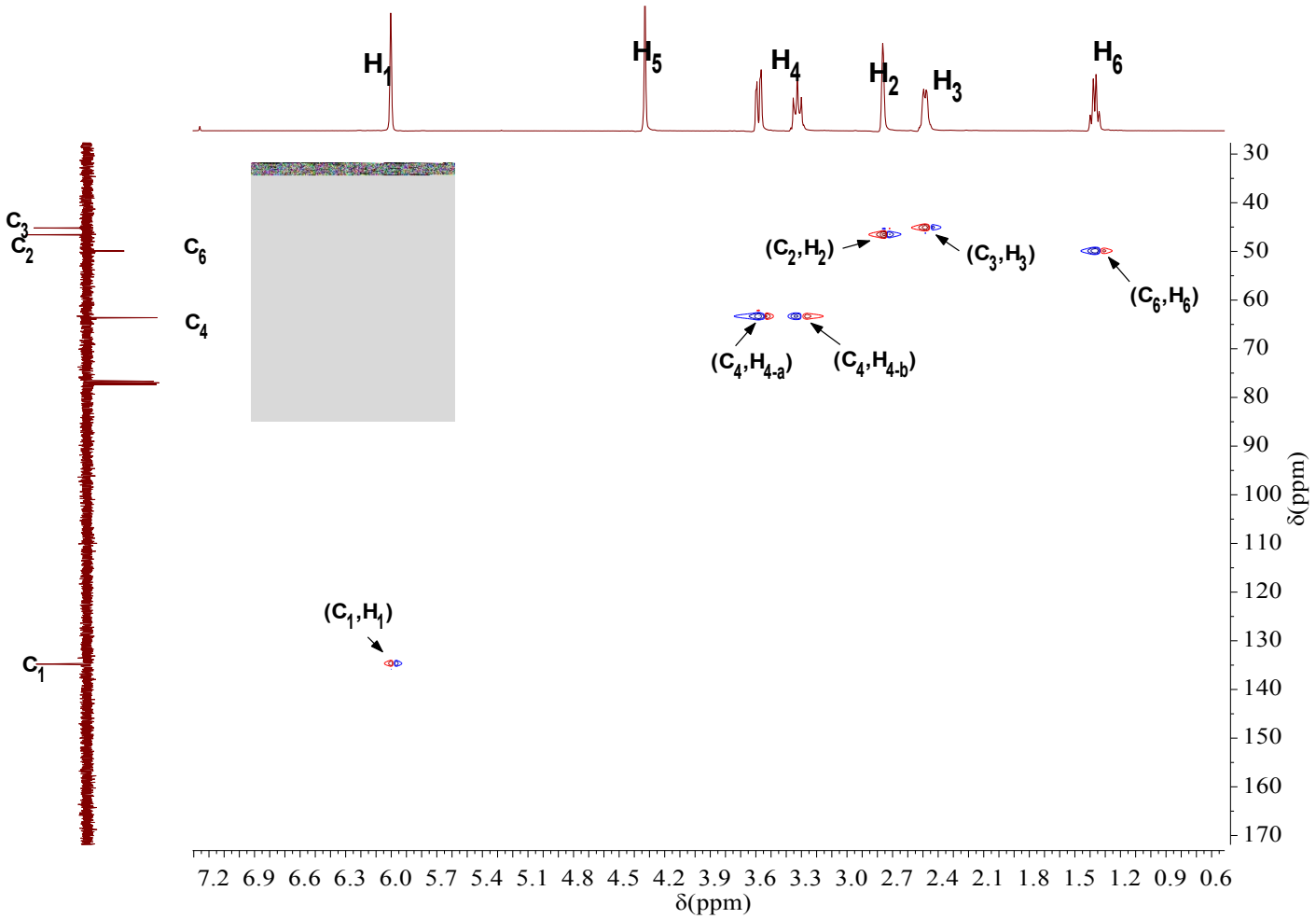

Figure S4 : The gHSQC-NMR spectrum of norbornene-dimethanol (3) in $CDCl_3$

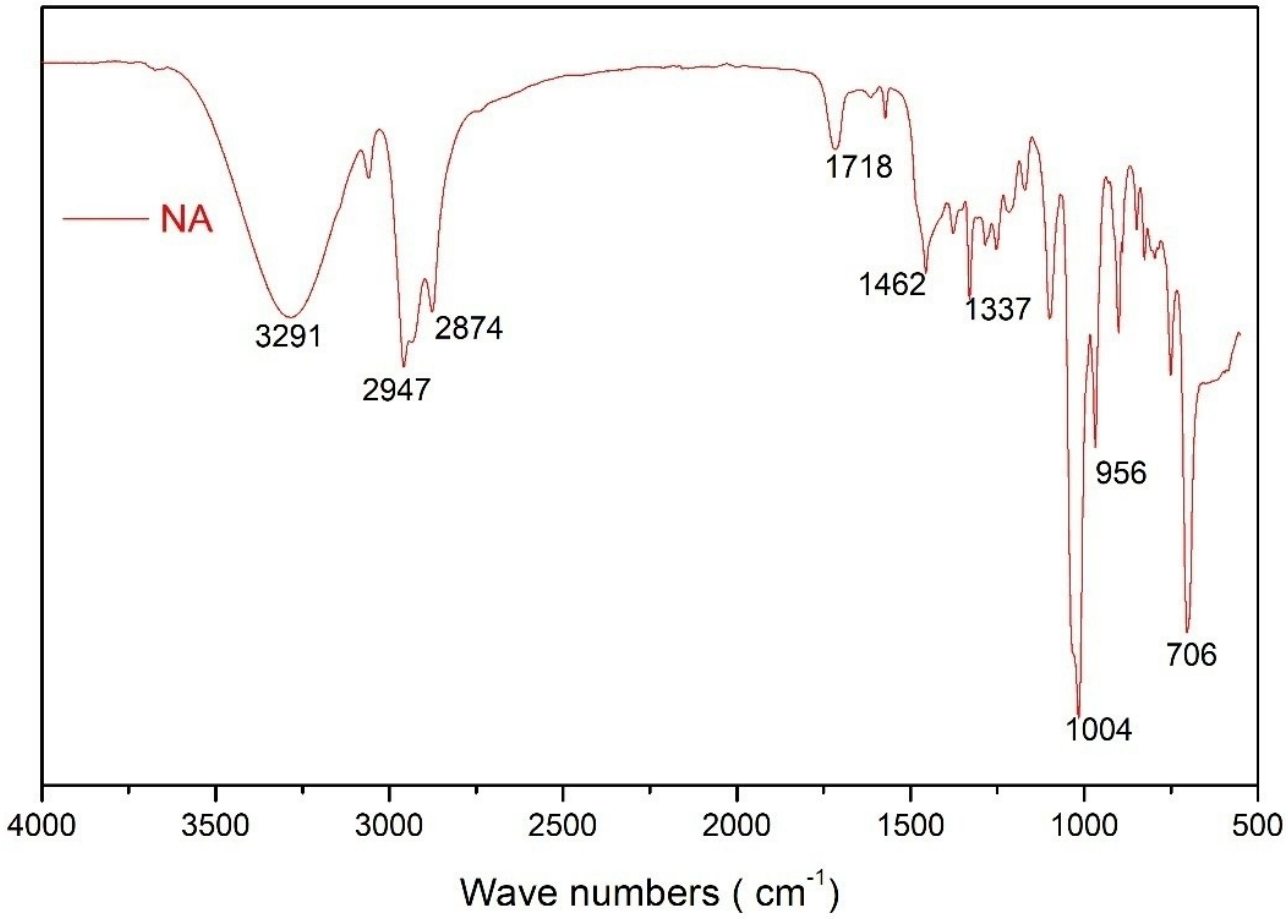

Figure S5 : The FT-IR spectrum of norbornene-dimethanol (3)

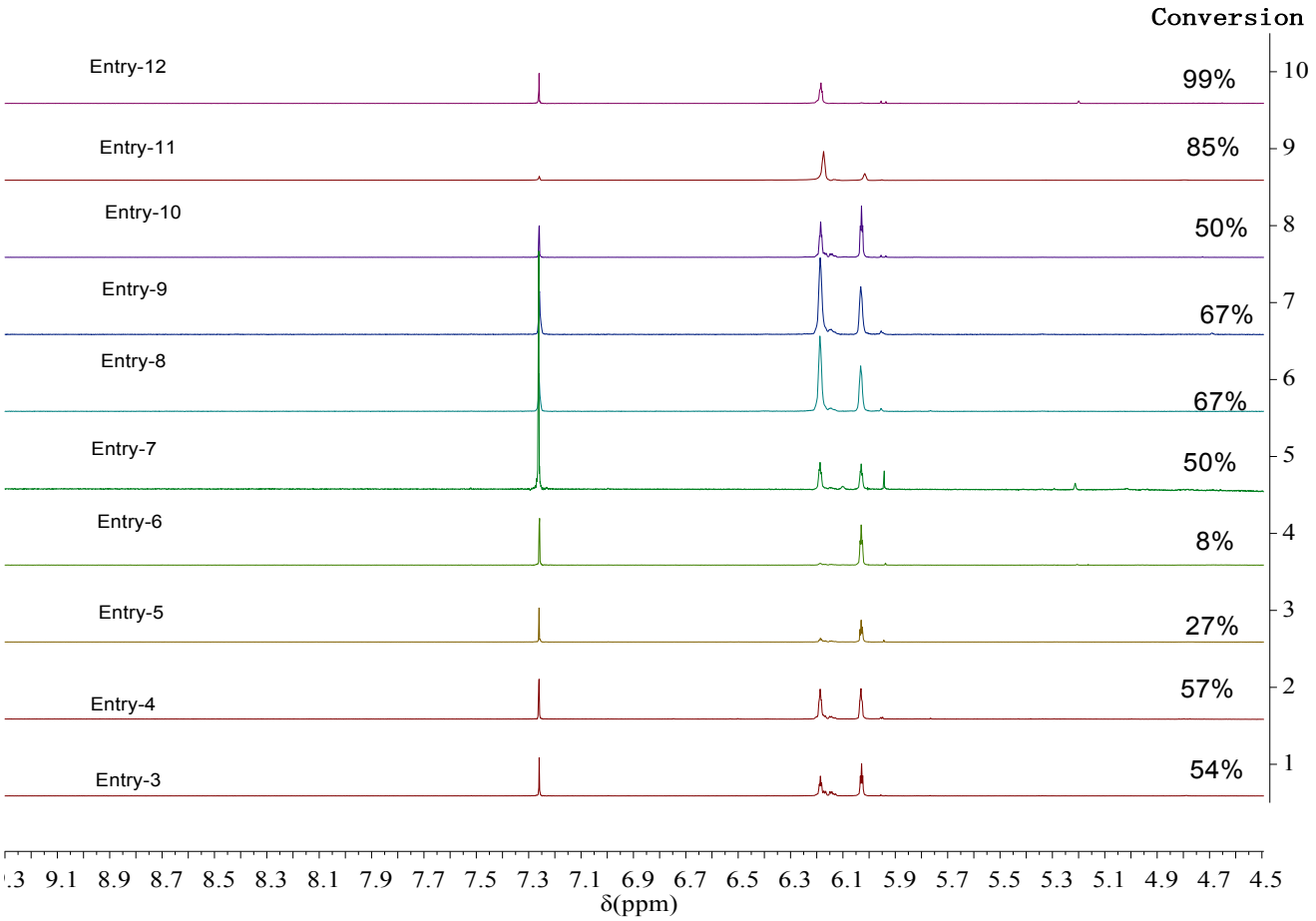

Figure S6 Array NMR study on the optimization on chloroacetylation on diol 3

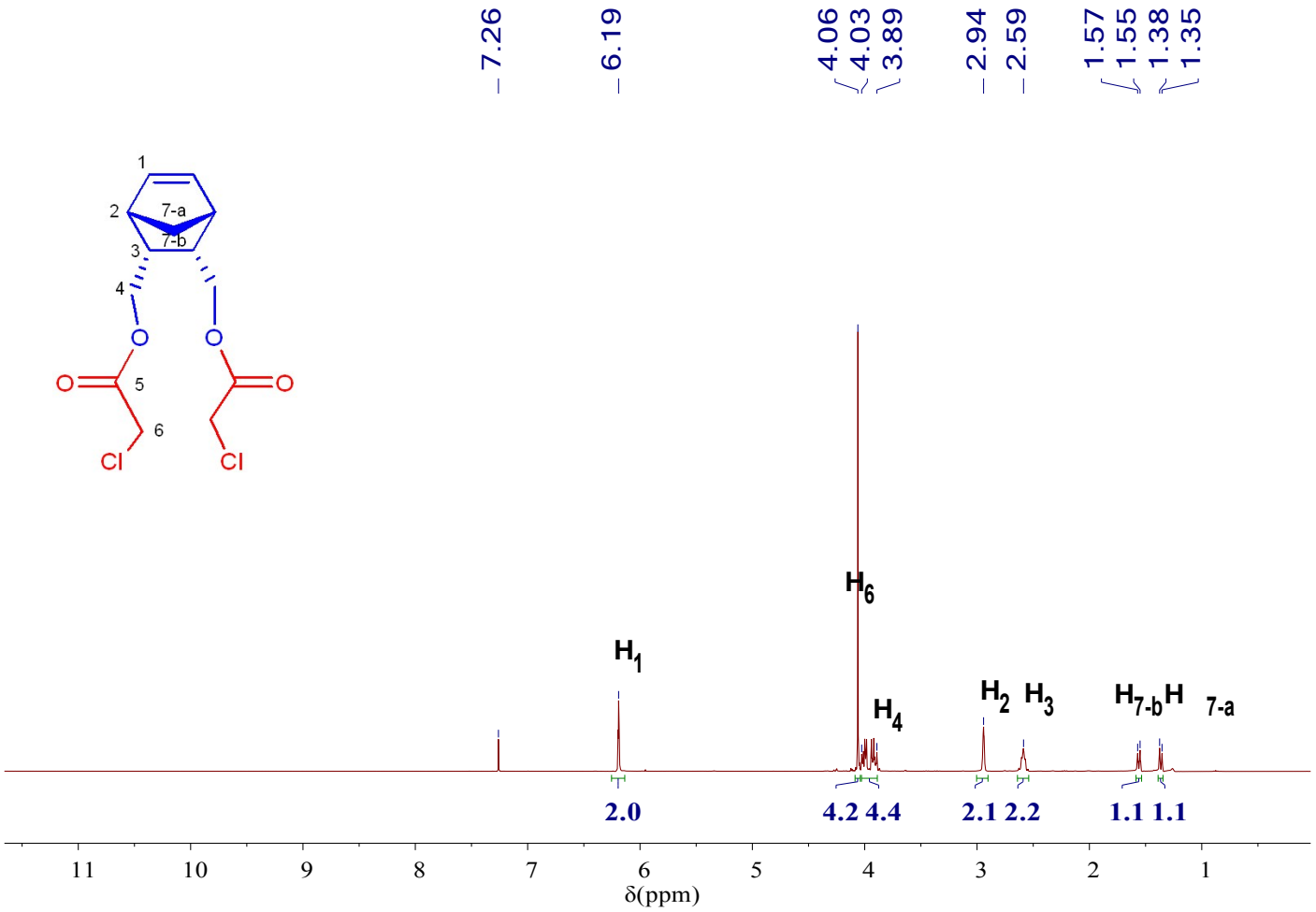

Figure S7 The ^{1}H-NMR spectrum of NBCA (4) in $CDCl_3$

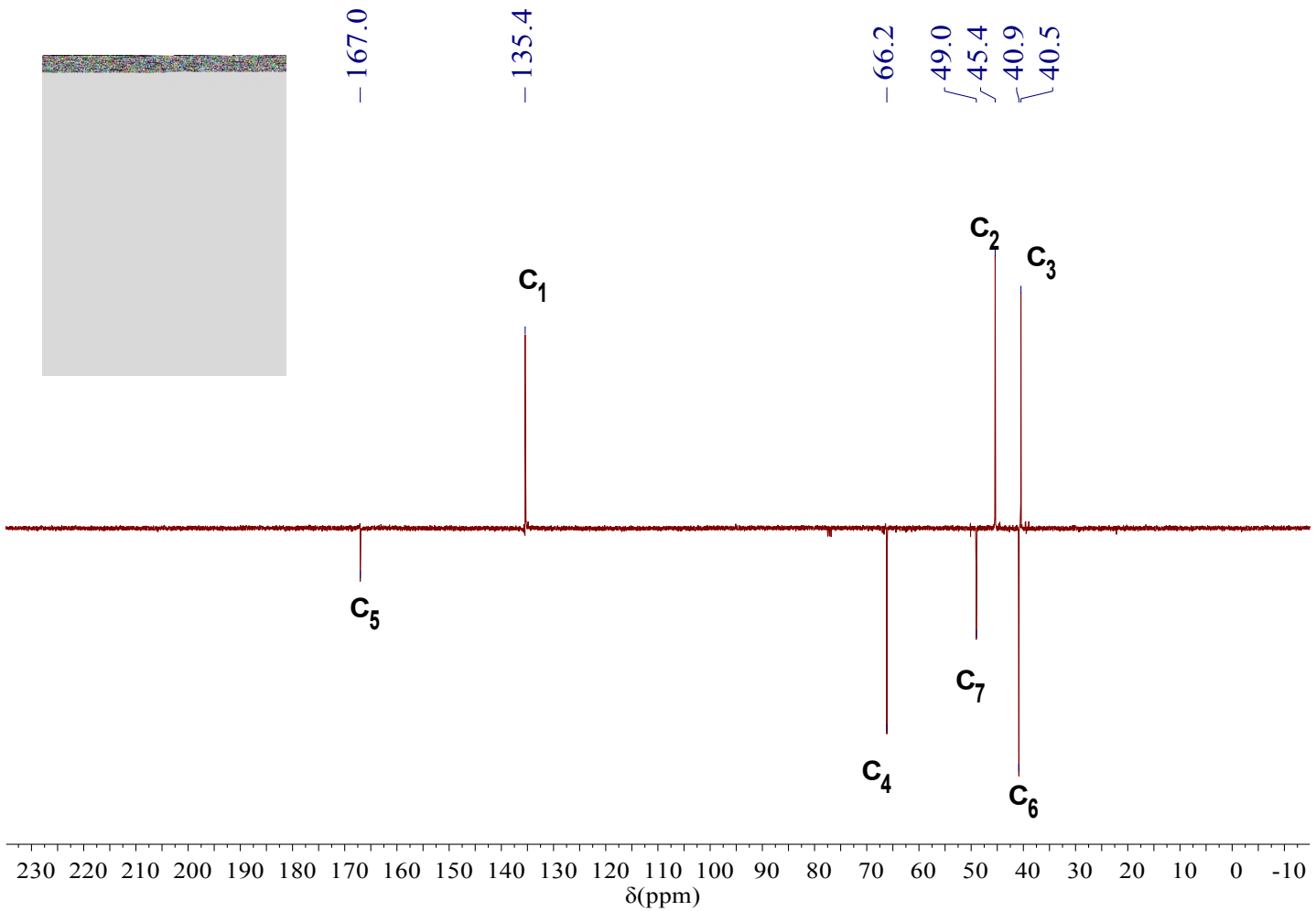

Figure S8 : The^{13}C-NMR spectrum of NBCA (4)in $CDCl_3$

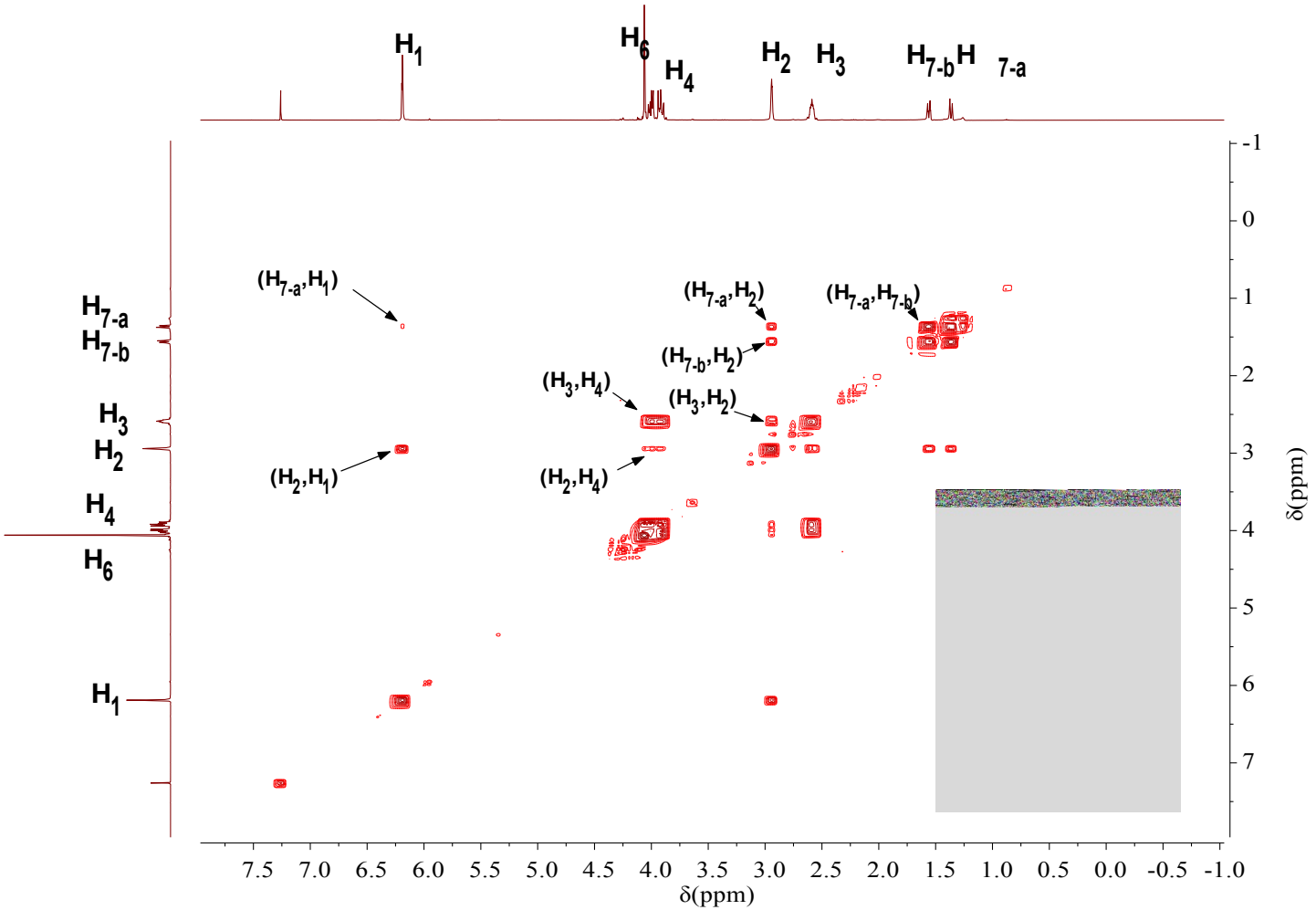

Figure S9 :The gCOSY-NMR spectrum of NBCA (4)in $CDCl_3$

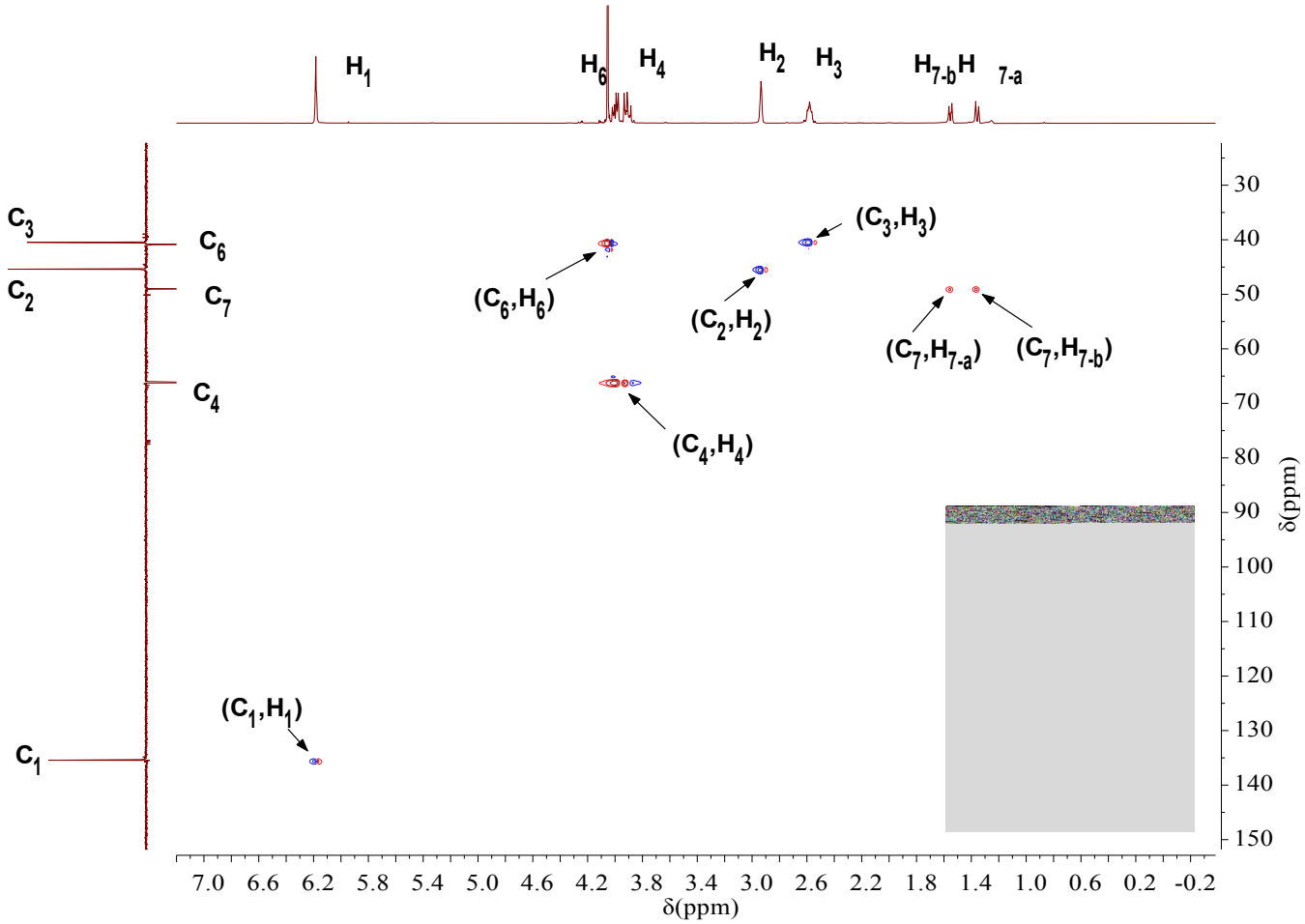

Figure S10 : The gHSQC-NMR spectrum of NBCA (4)in $CDCl_3$

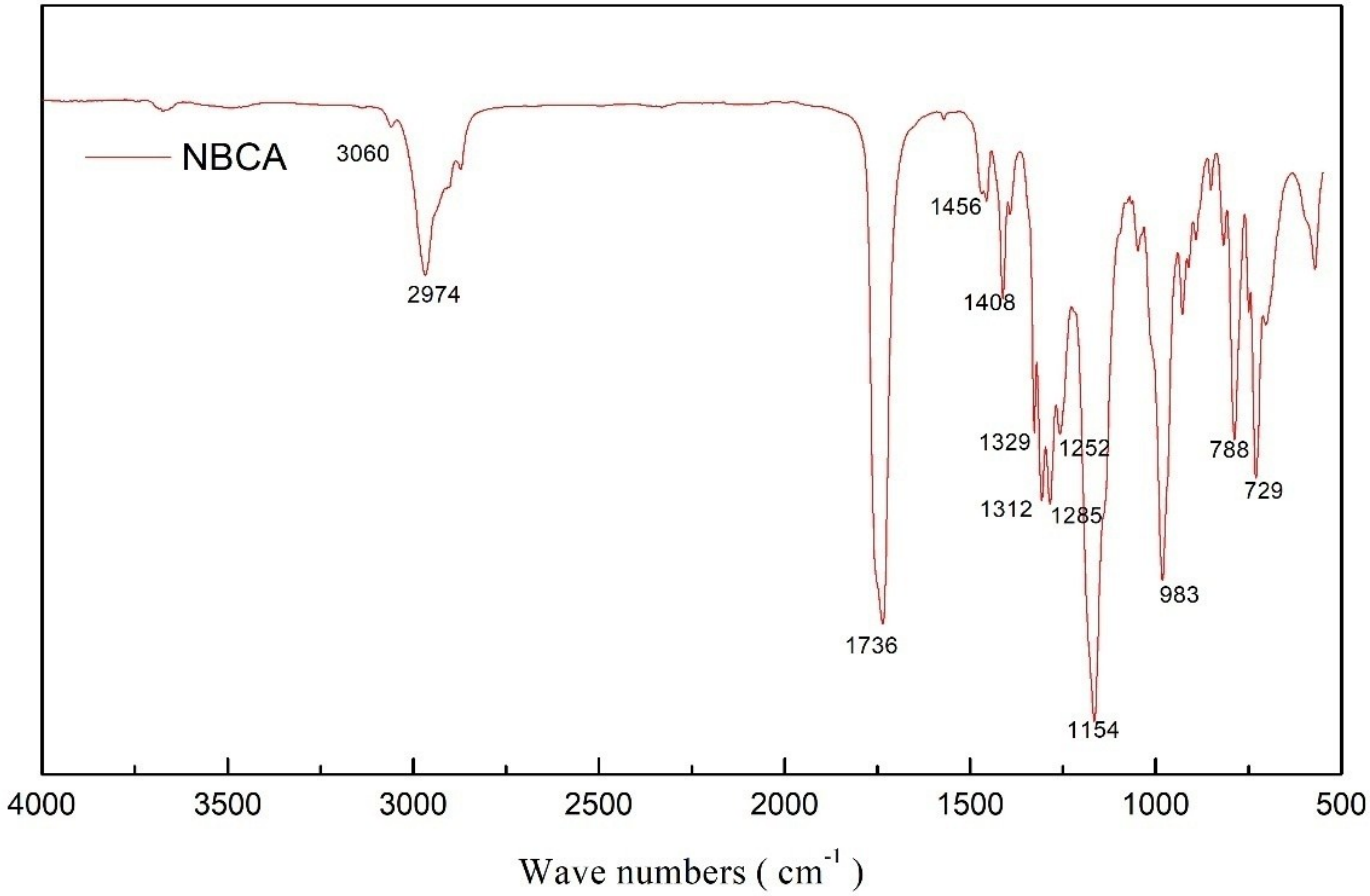

Figure S11 : TheFT-IR spectrum of NBCA (4)

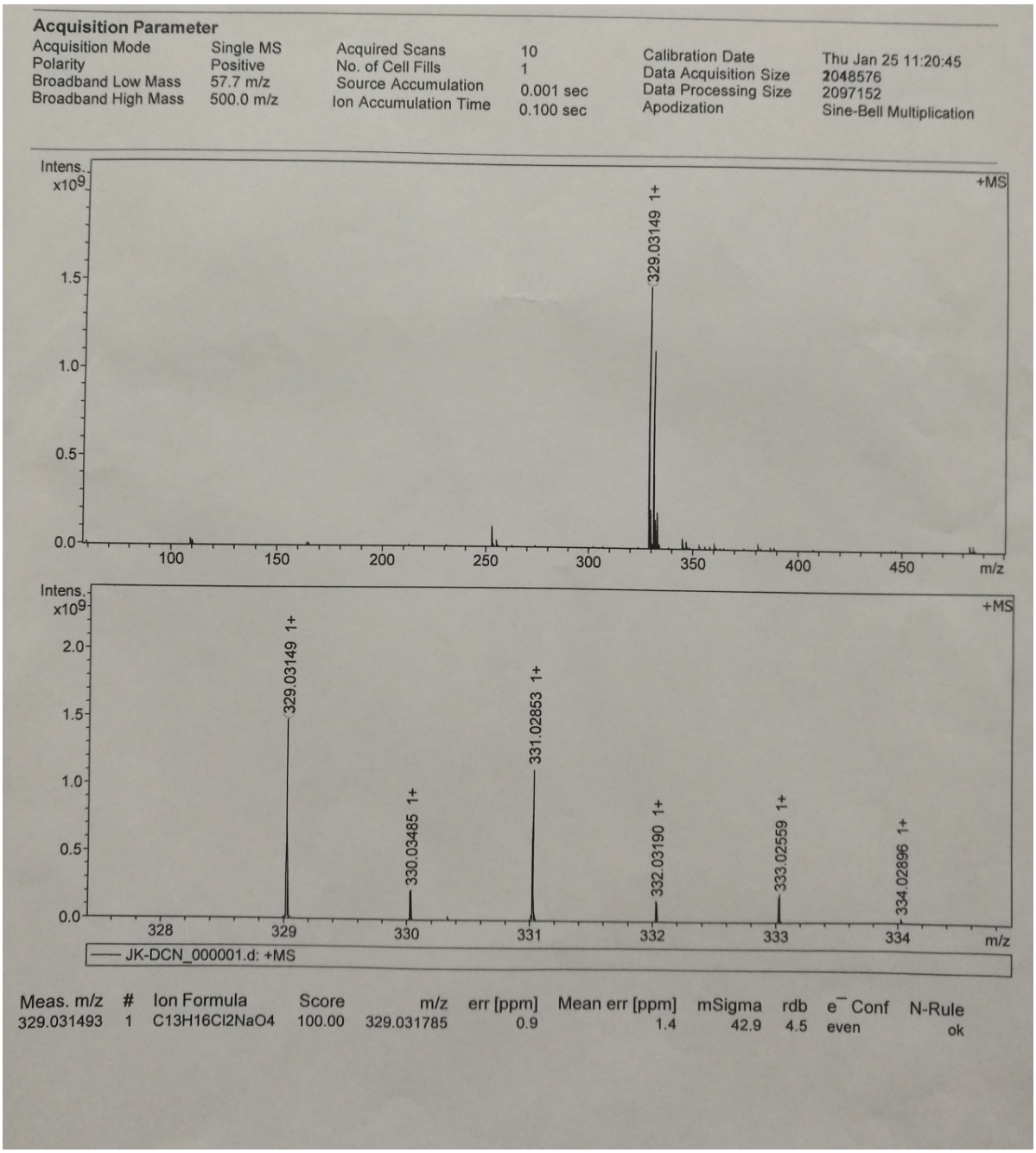

Figure S12 : The HR-MS spectrum of NBCA(4)

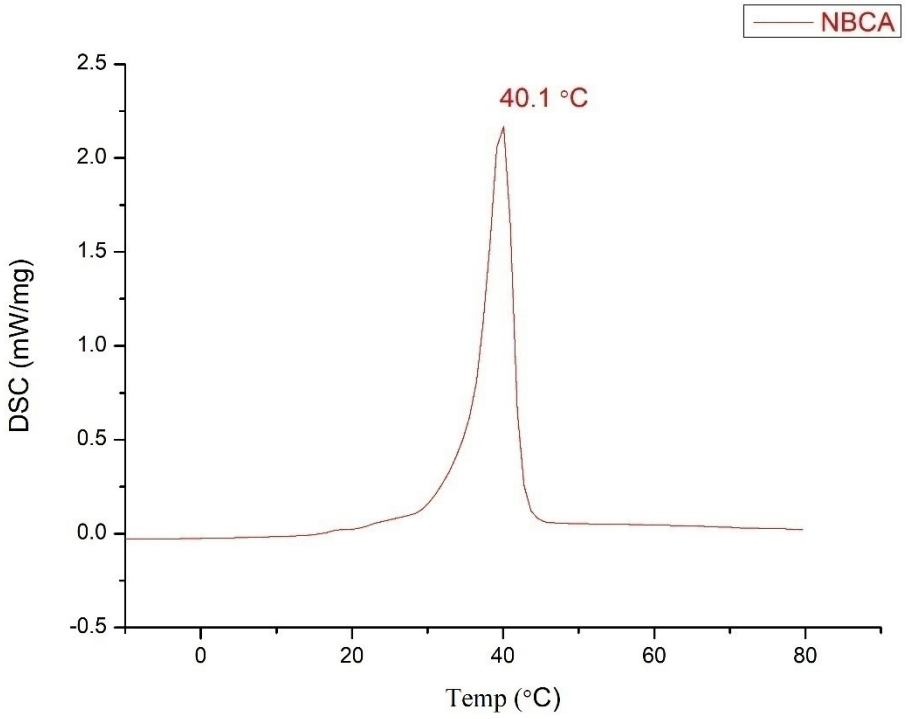

Figure S13:The DSCgraph of NBCA (4)

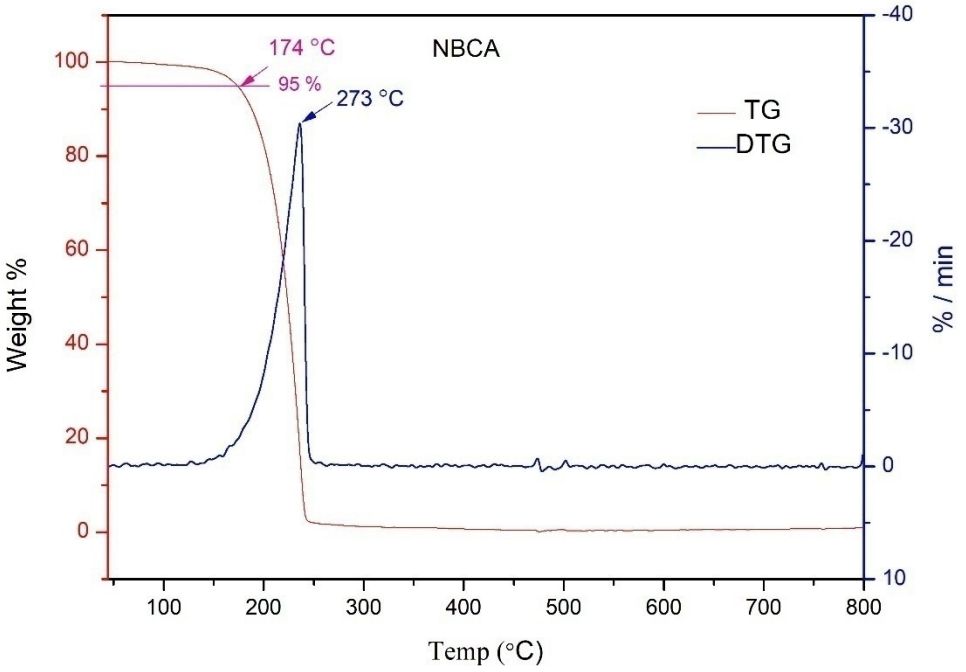

Figure S14: The TGAgraph of NBCA (4)

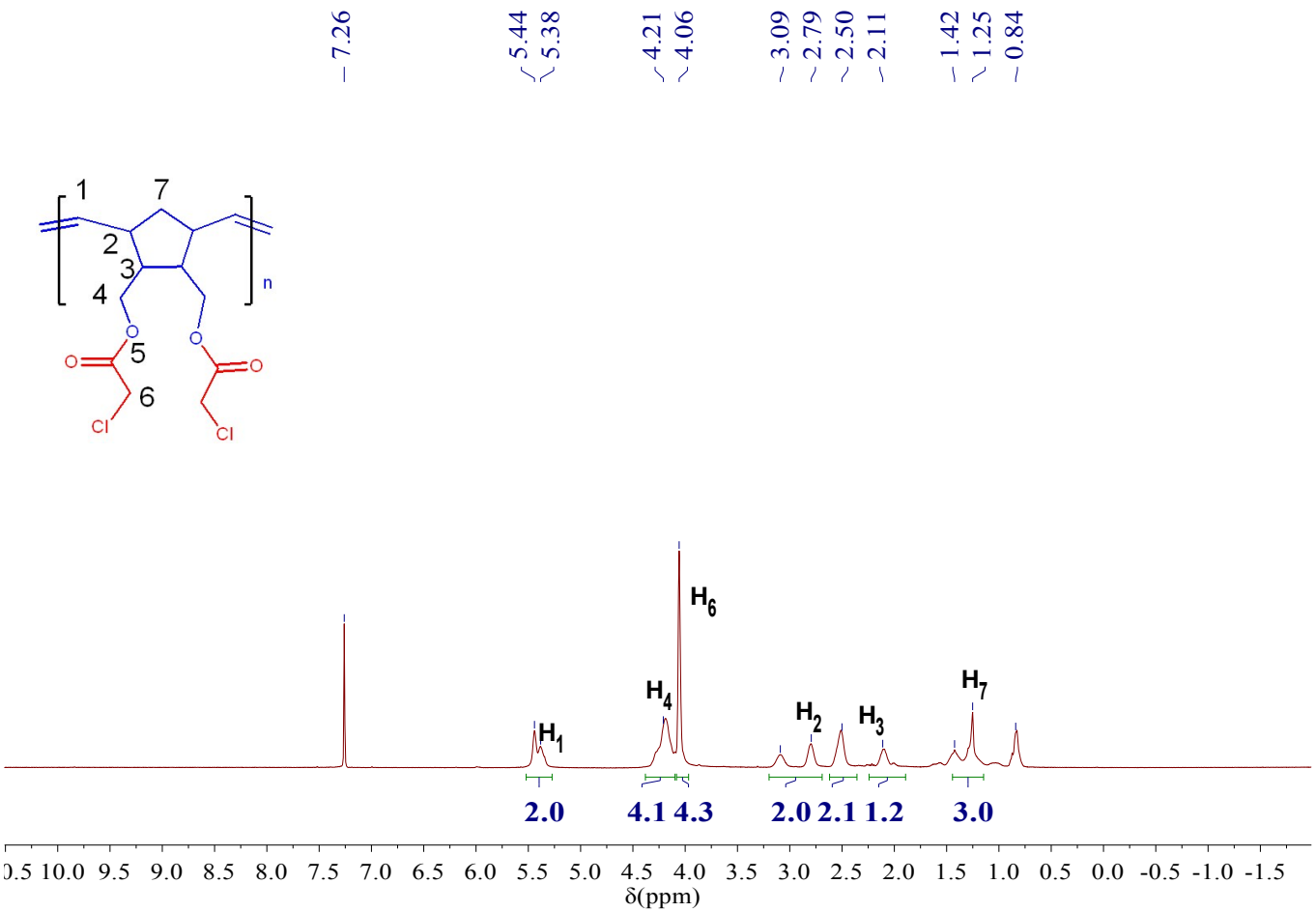

Figure S15 : The ^{1}H-NMR spectrum of PNBCA (5) in $CDCl_3$

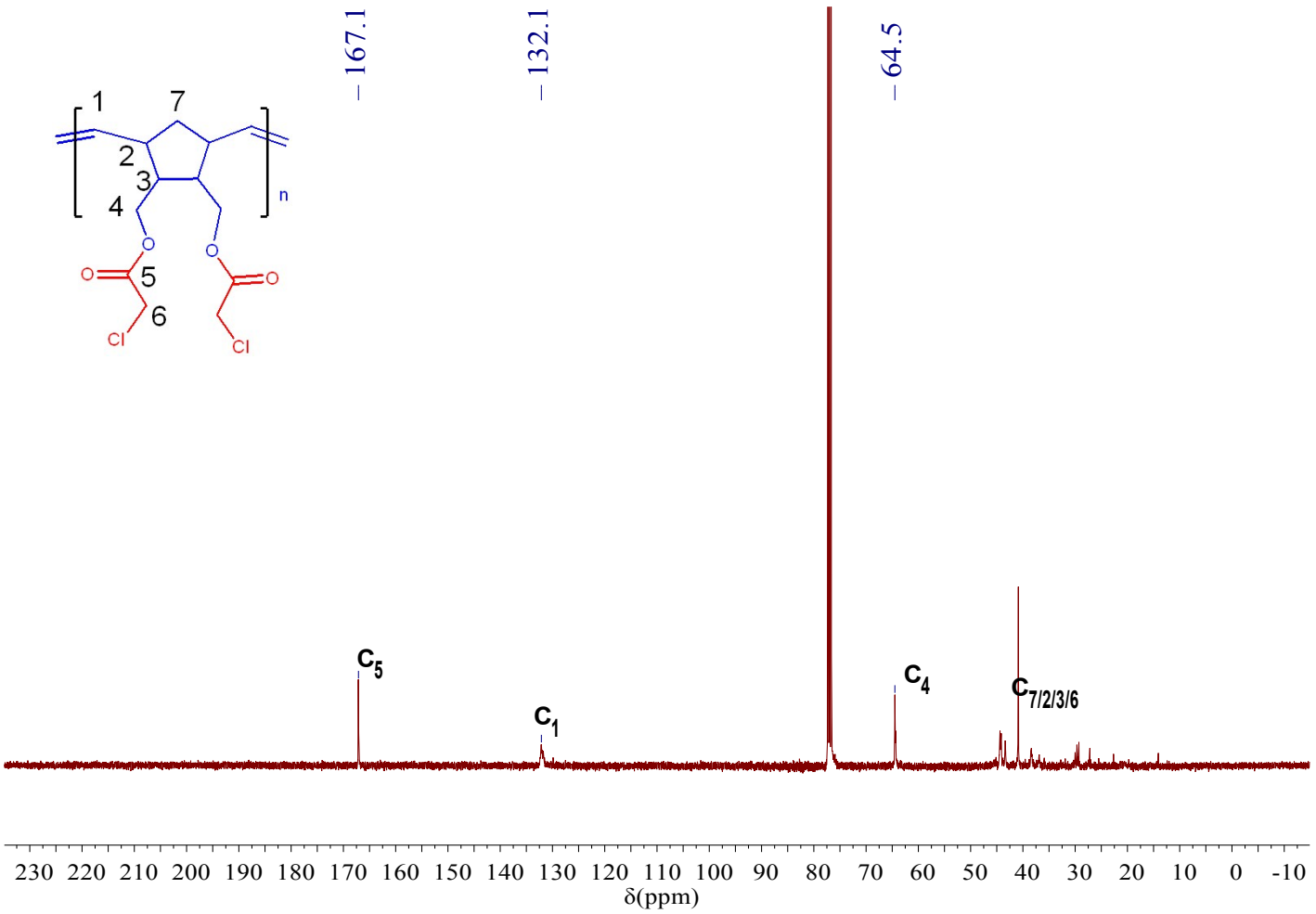

Figure S16:The^{13}C-NMR spectrum of PNBCA (5) in $CDCl_3$

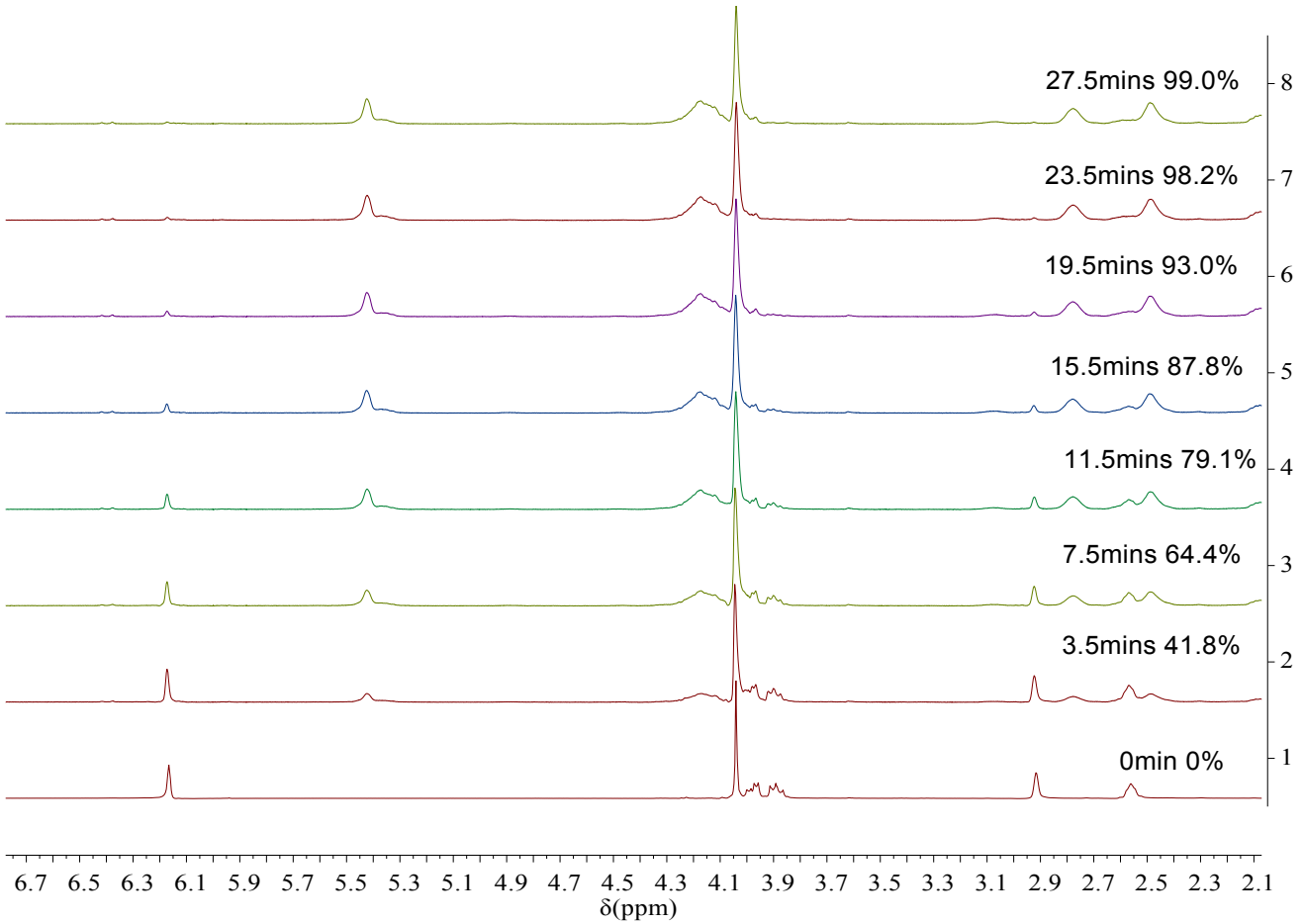

Figure S17:The array ^{1}H-NMR on ROMP reaction in $CDCl_3$ (Entry 1, Table 2)

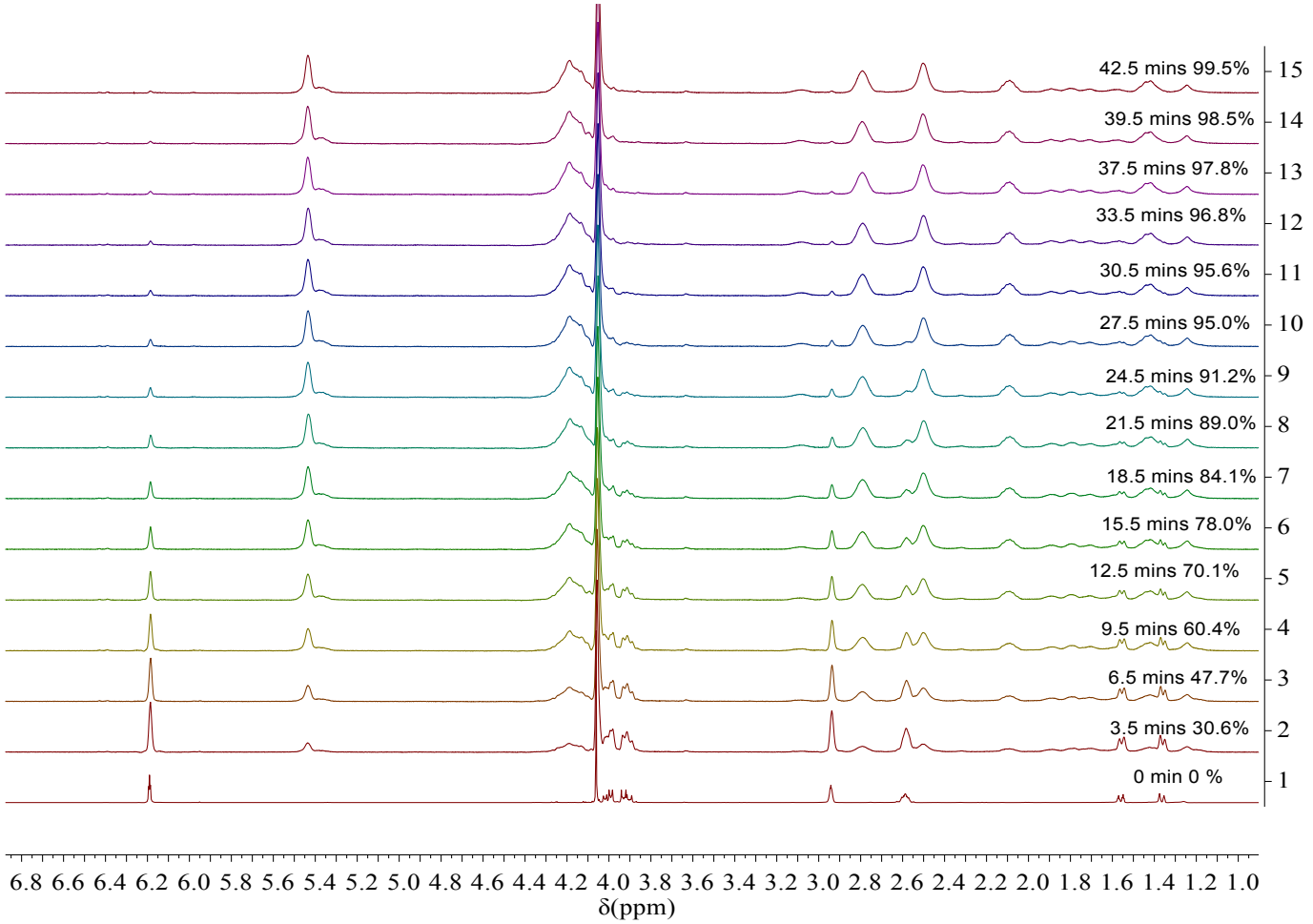

Figure S18: The array ^{1}H-NMR on ROMP reaction in $CDCl_3$ (Entry 2, Table 2)

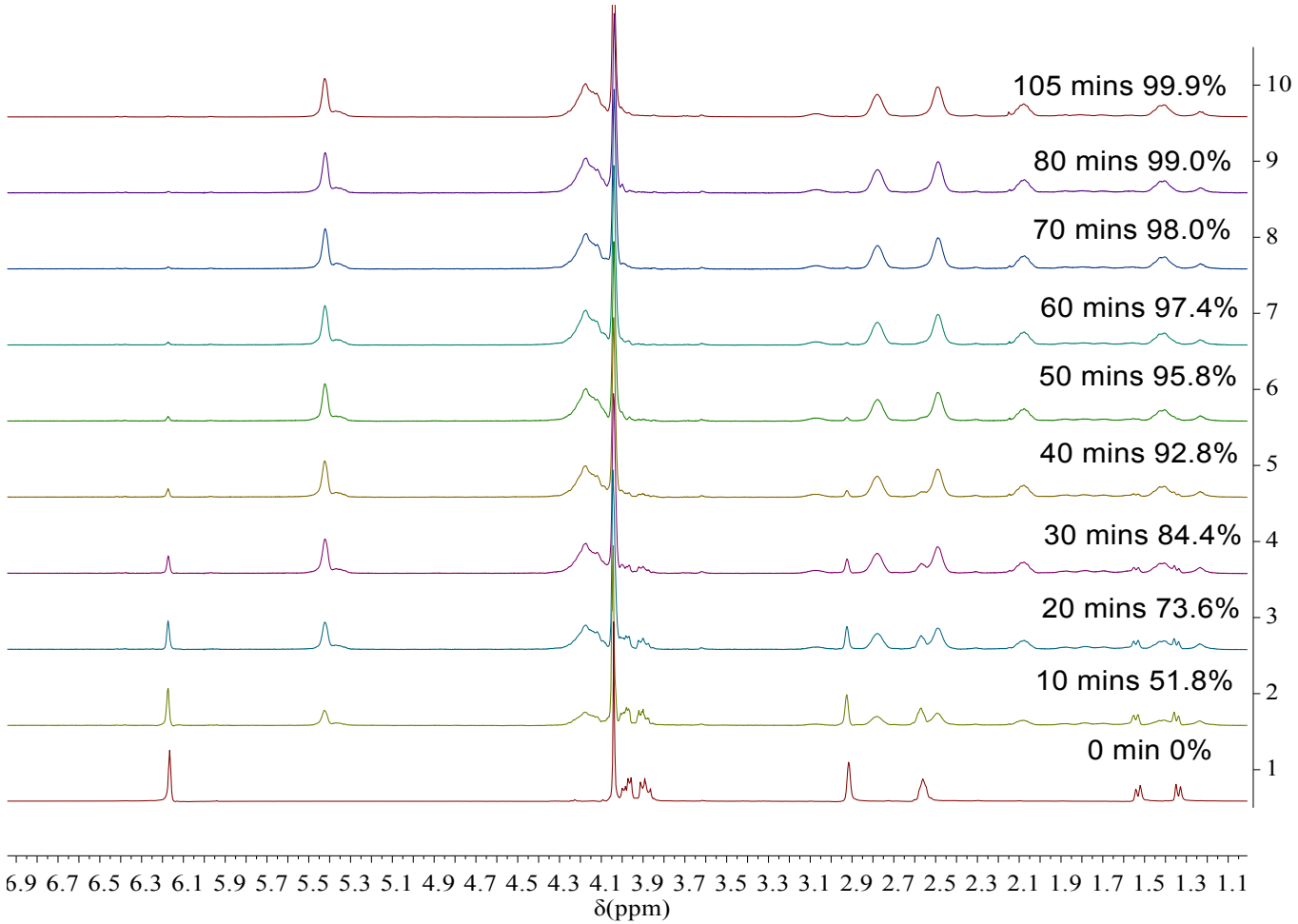

Figure S19: The array ^{1}H-NMR on ROMP reaction in $CDCl_3$ (Entry 4, Table 2)

Figure S20 Photograph on solvent-free ROMP reaction on NBCA (4)

Figure S21: Photograph ofROMP adduct before (top) and after (bottom) removal of Ru comtaminant

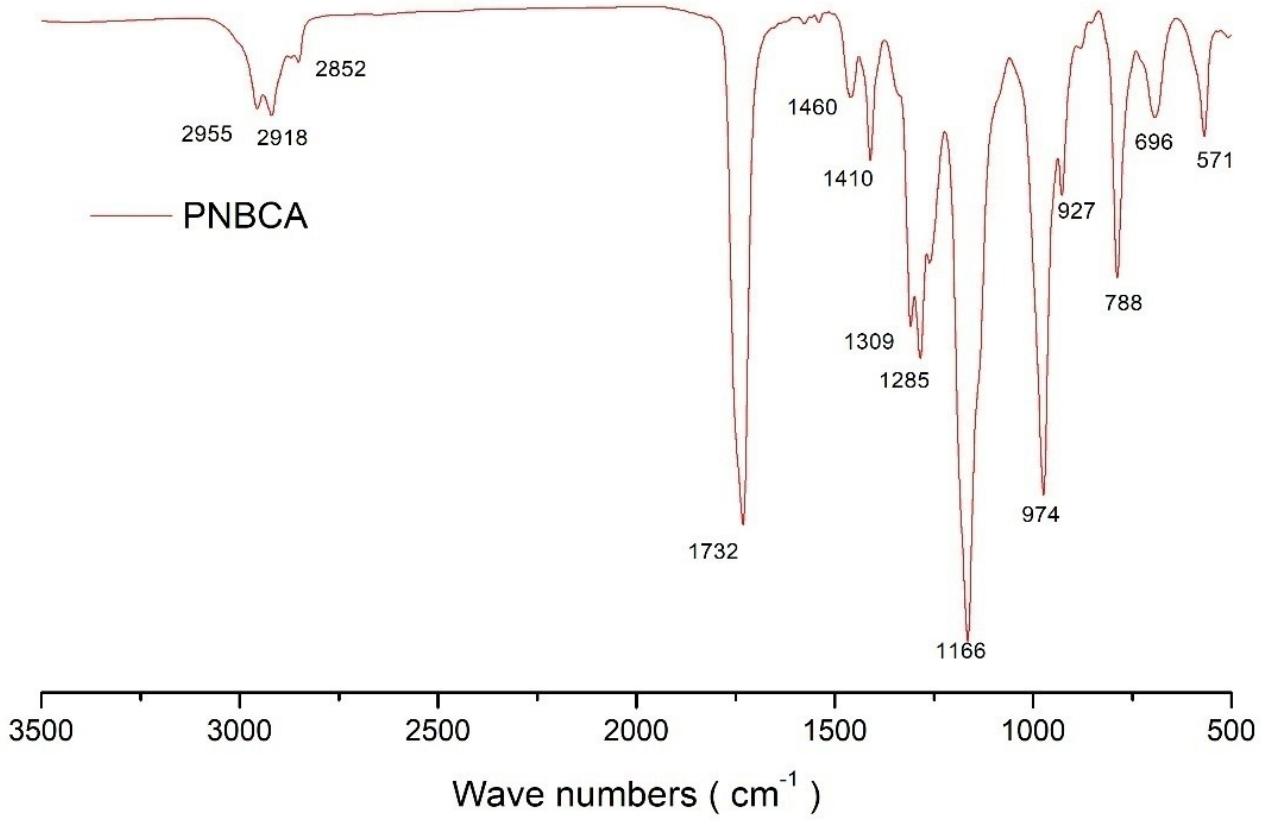

Figure S22 : The FT-IR spectrumof PNBCA (5)

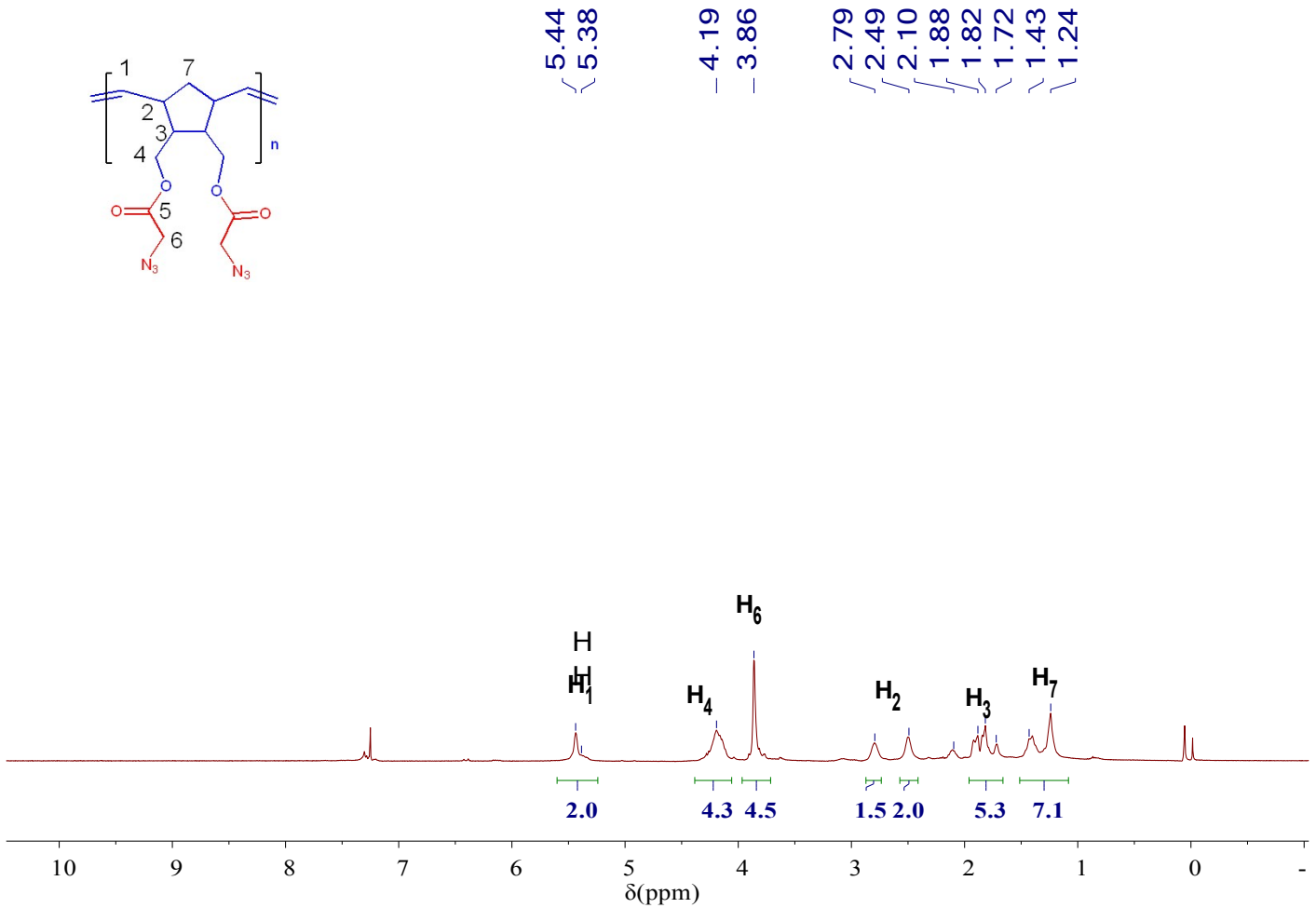

Figure S23 : The ^{1}H-NMR spectrum of PNBAA (6) in $CDCl_3$

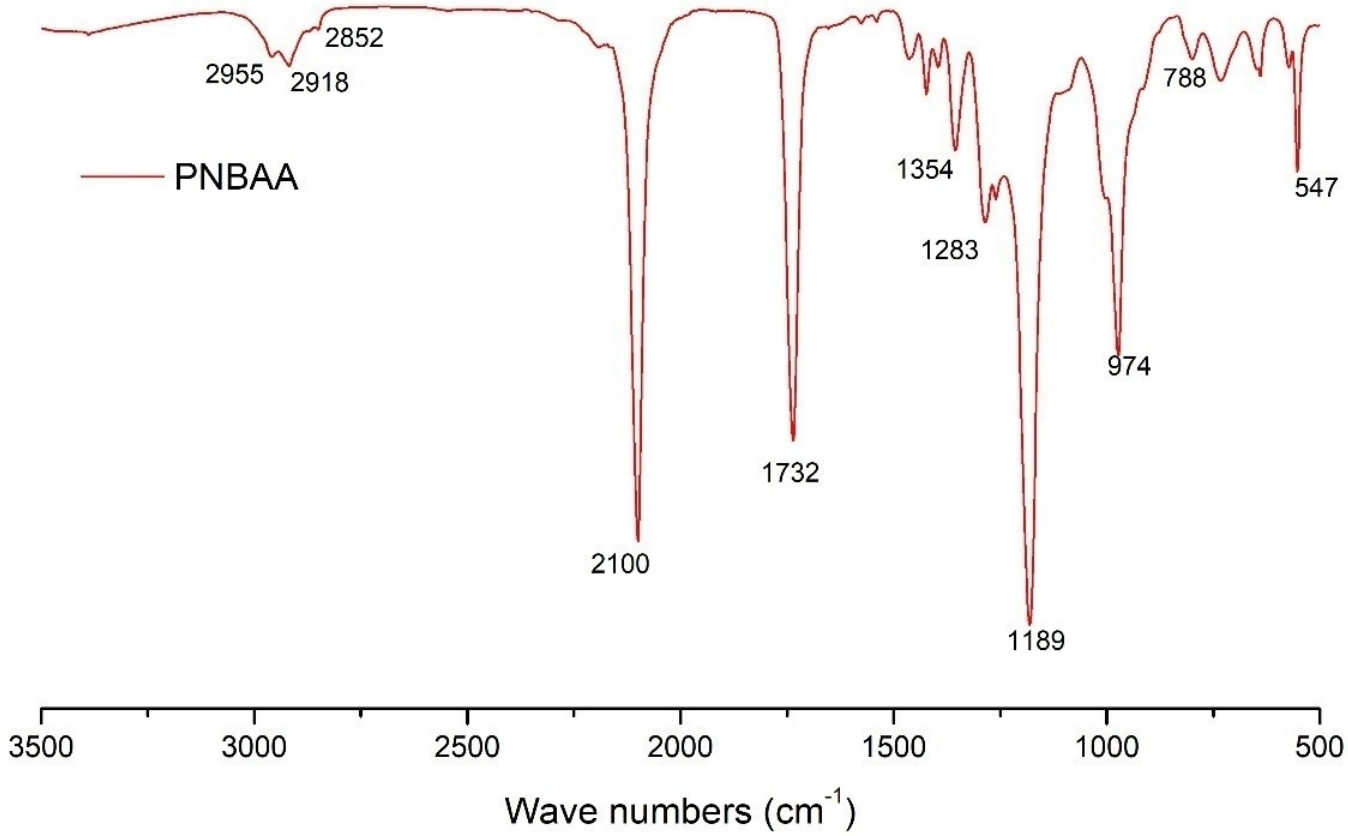

Figure S24 : The FT-IR spectrumof PNBAA (6)

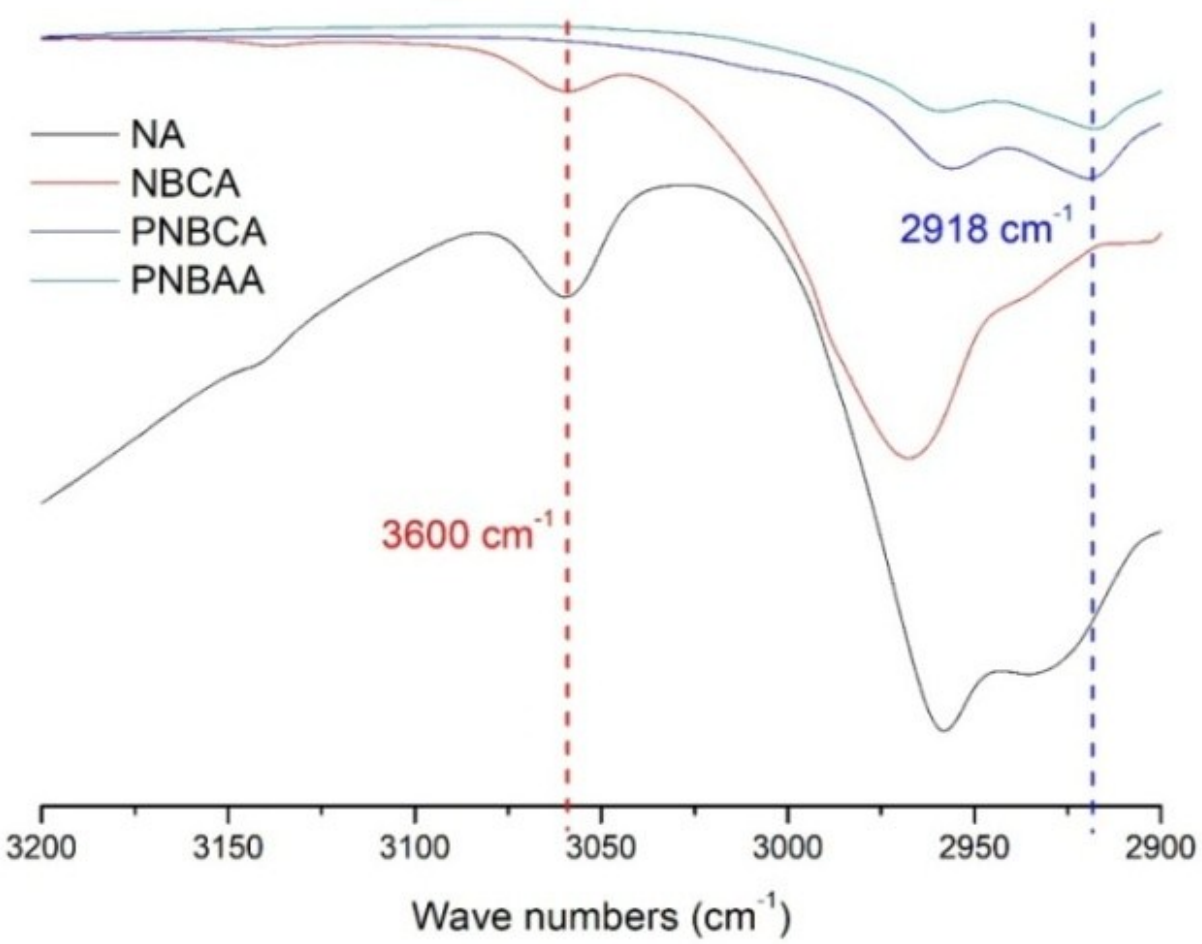

Figure S25 The comparison among the FT-IR spectra of monomers and polymers

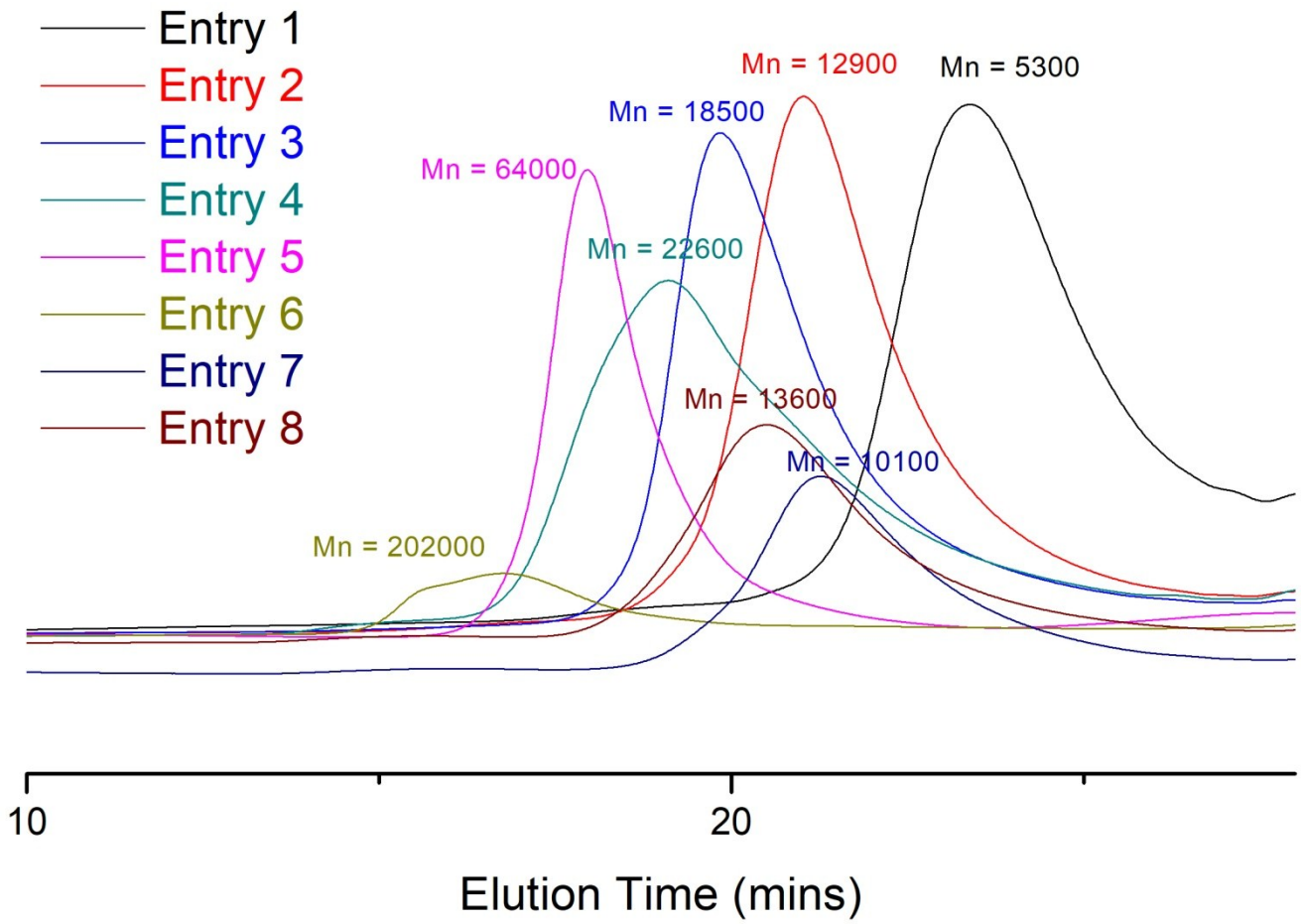

Figure S26 The GPC graph of PNBCA with different Mn

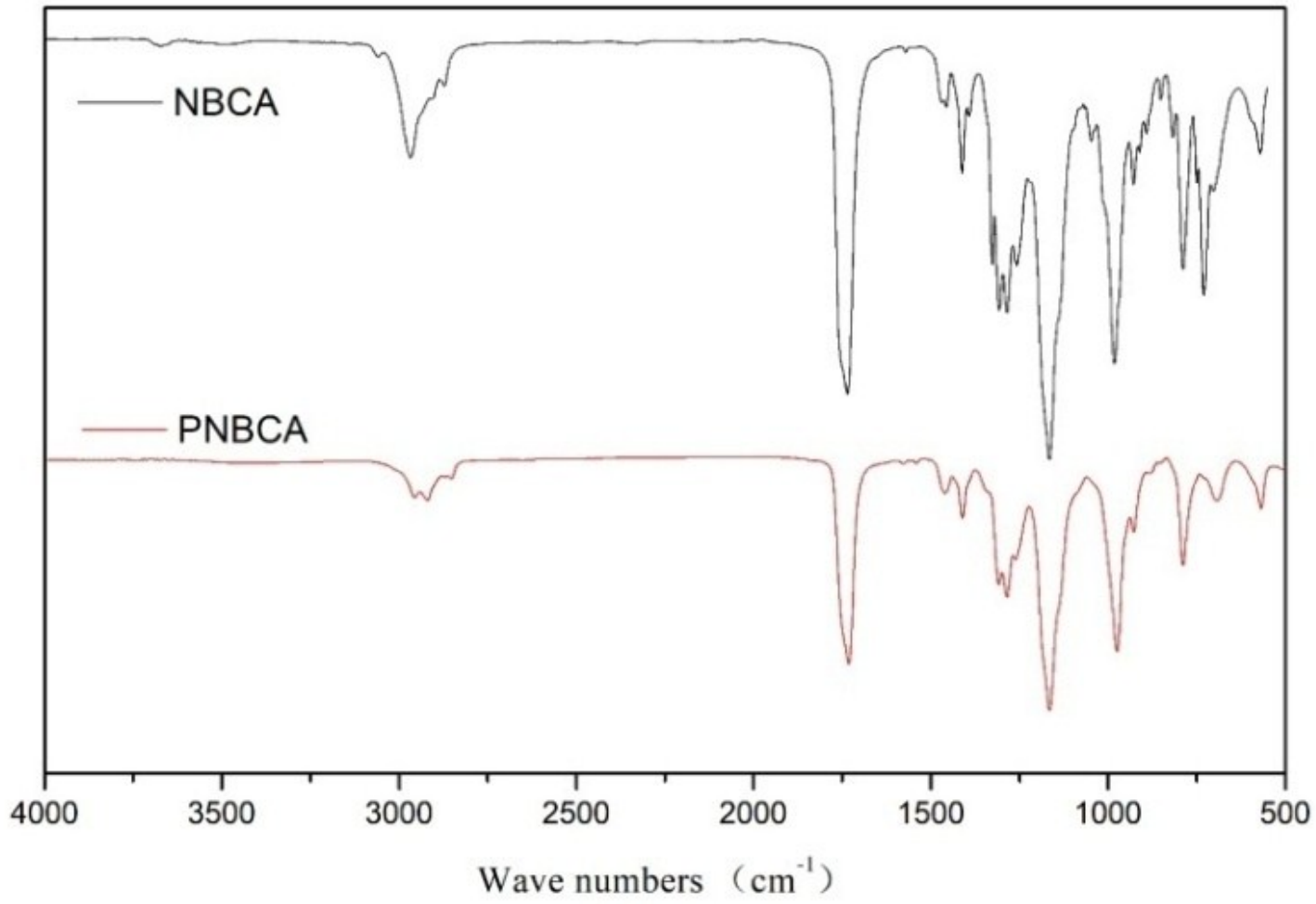

Figure S27 The comparison of FT-IR spectra between NBCA and PNBCA

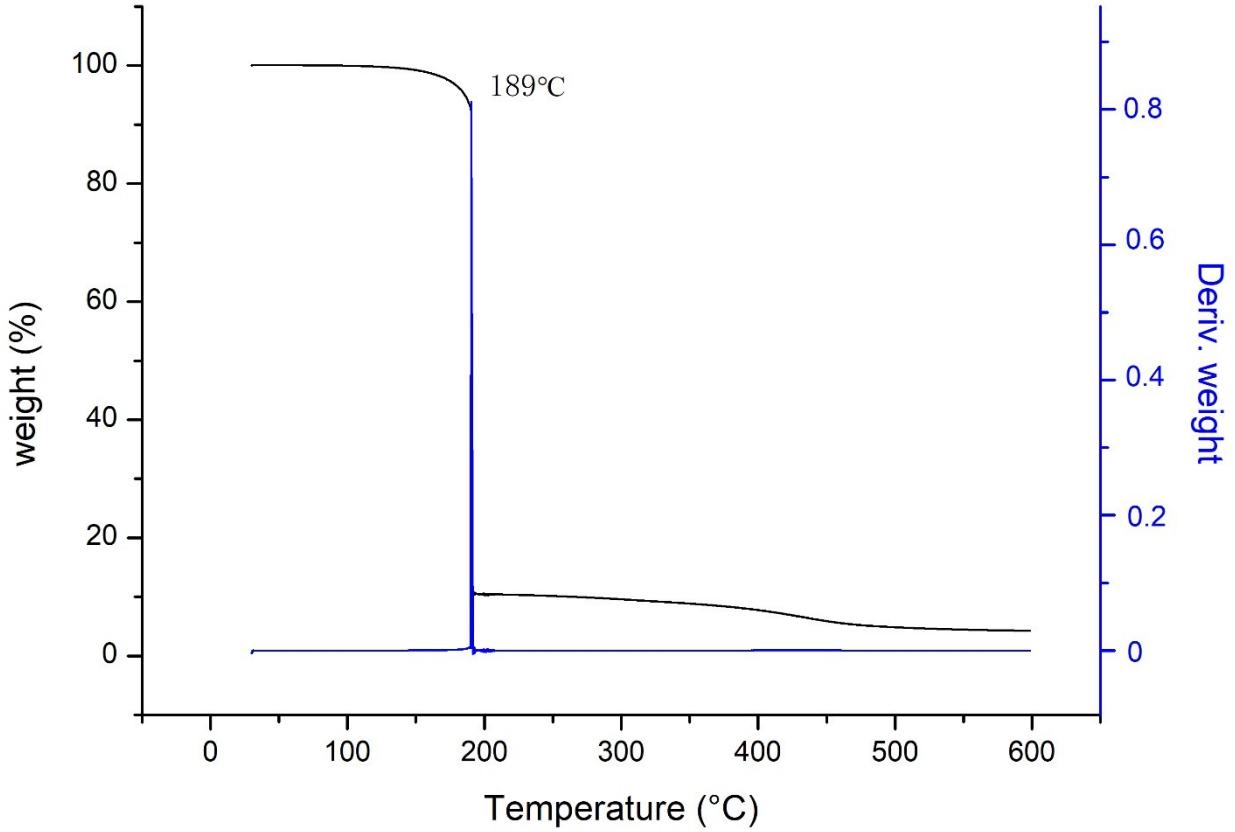

Figure S28：The TG and DTG graph of PNBAA (6)

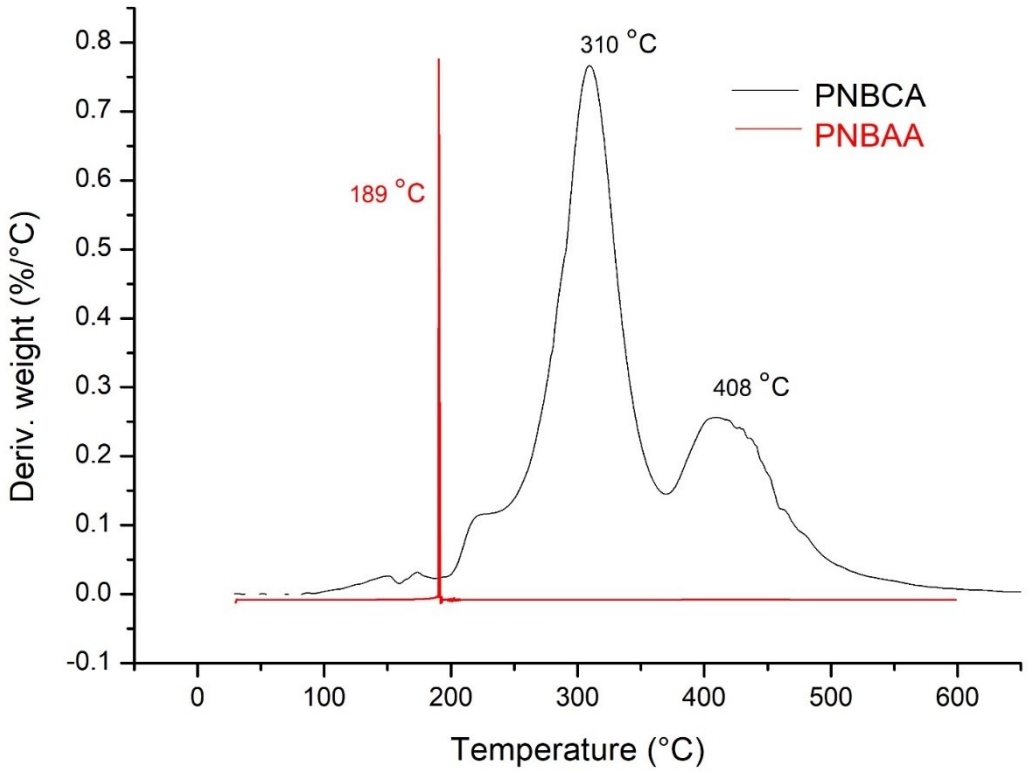

Figure S29 :The DTG graph of PNBCA(5) and PNBAA (6)

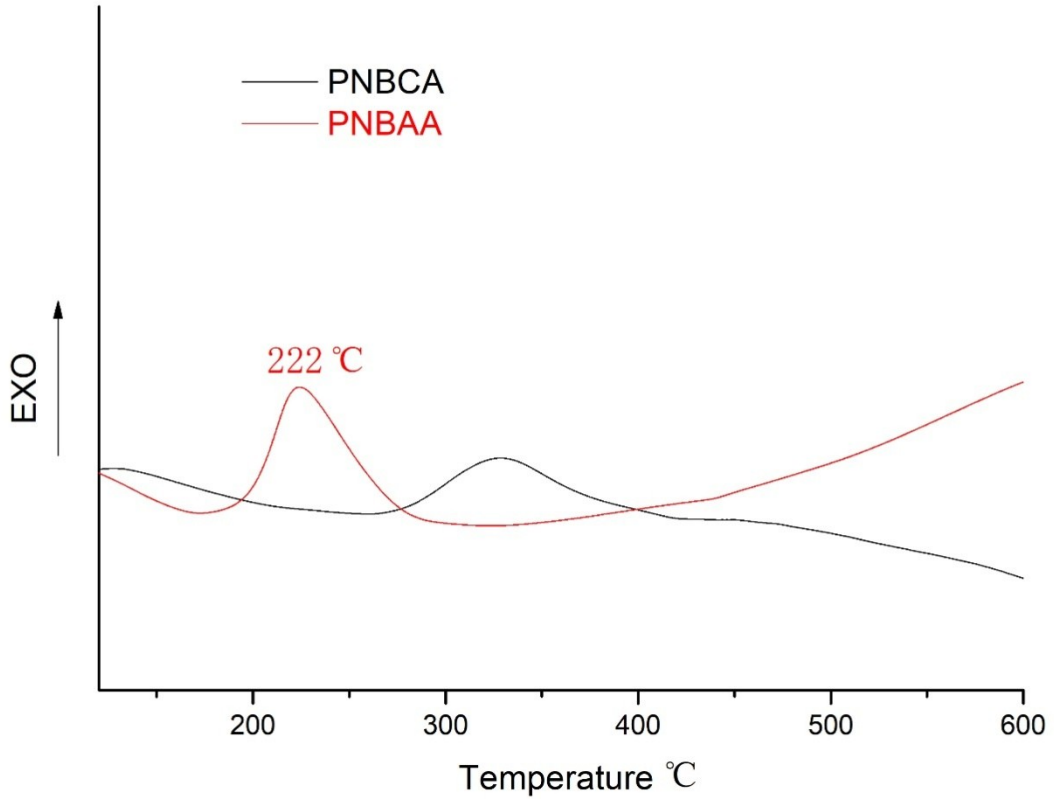

Figure S30 : The DSC graph of PNBCA(5) and PNBAA (6) from 80 °C to 600 °C