Electronic Supplementary Material (ESI) for Polymer Chemistry

Microporous co-polymers for increased gas selectivity

Robert Dawson,*[a] Matthew Corker,[a] Thanchanok Ratvijitvech,[a] Andrew I. Cooper[a] and Dave J. Adams*[a]

Contents

1. Elemental Analysis

Table S1. Example Elemental Analysis for Benzene/Aniline

% Aniline	% Benzene	Expected % C	Found % C	Expected % H	Found % H	Expected % N	Found % N
0	100	94.08	83.66	5.92	5.34	0.00	0.00
10	90	92.72	83.12	5.93	5.36	1.35	1.11
20	80	91.39	80.51	5.94	5.26	2.66	1.96
30	70	90.10	77.59	5.95	5.18	3.94	2.81
40	60	88.85	74.97	5.97	5.11	5.18	3.90
50	50	87.64	74.43	5.98	5.61	6.39	5.54
60	40	86.45	70.28	5.99	5.45	7.56	6.56
70	30	85.30	65.59	6.00	5.30	8.70	7.41
80	20	84.18	64.23	6.00	5.14	9.82	7.88
90	10	83.09	64.18	6.01	5.11	10.90	9.40
100	0	82.02	62.90	6.02	5.06	11.96	9.40

Elemental Analysis of the networks was averaged over three repeat reactions

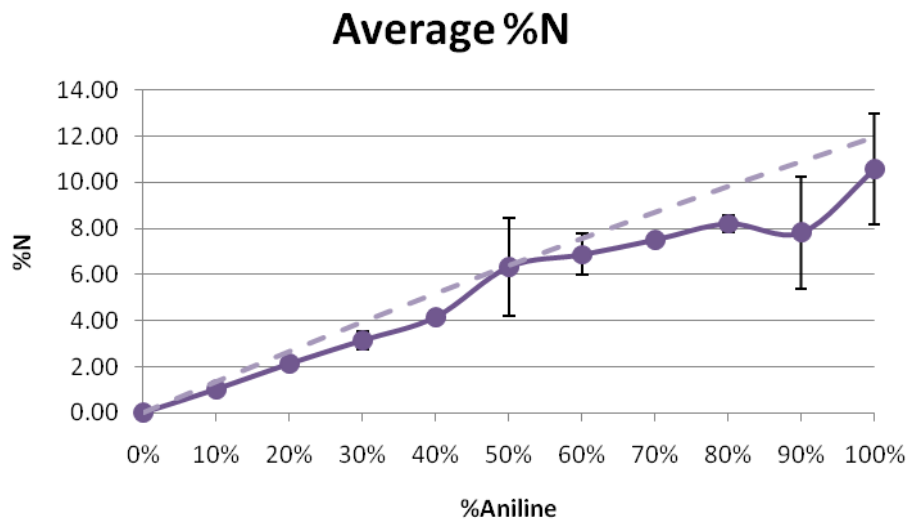

Fig S1. Average nitrogen content of three repeat syntheses. Dotted line represents theoretical nitrogen content.

2. FTIR

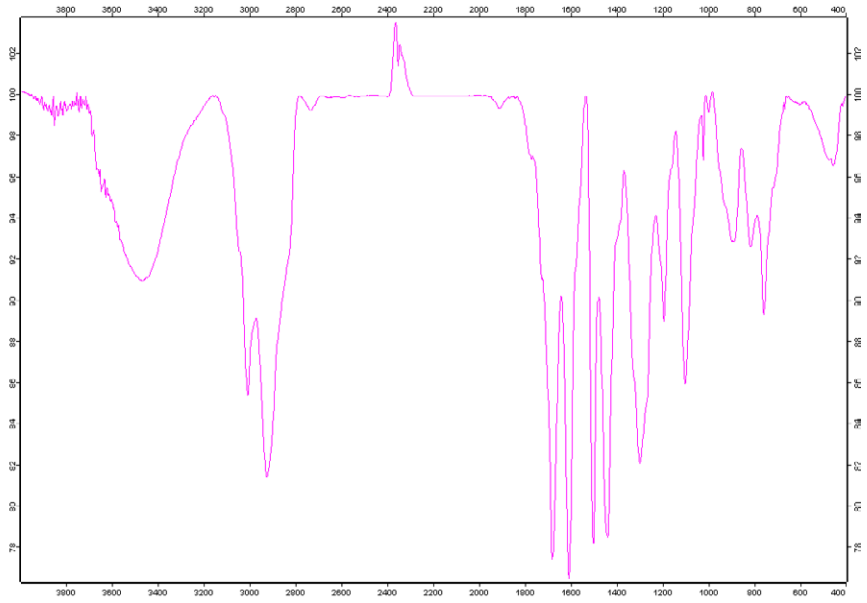

Fig. S2.1 FTIR spectrum of 0 % Aniline

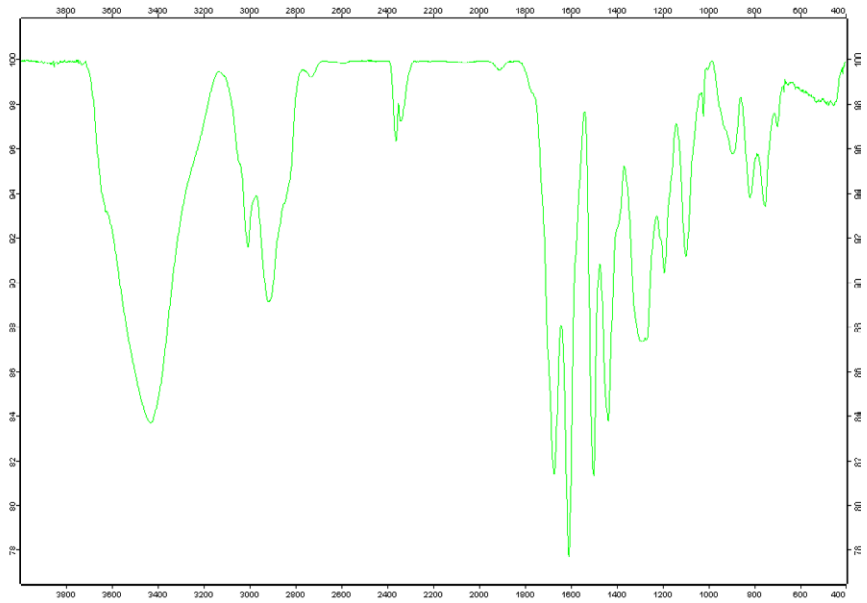

Fig. S2.2 FTIR spectrum of 10 % Aniline

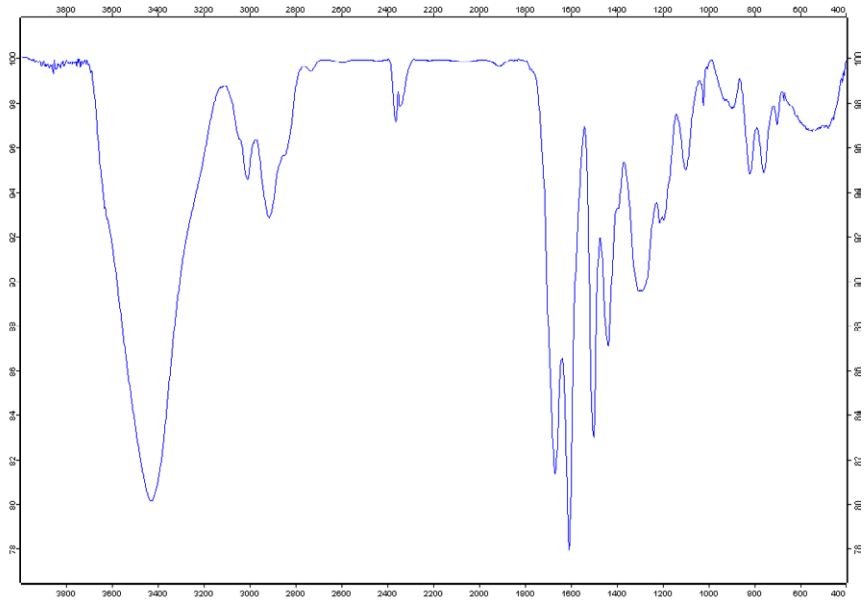

Fig. S2.3 FTIR spectrum of 20 % Aniline

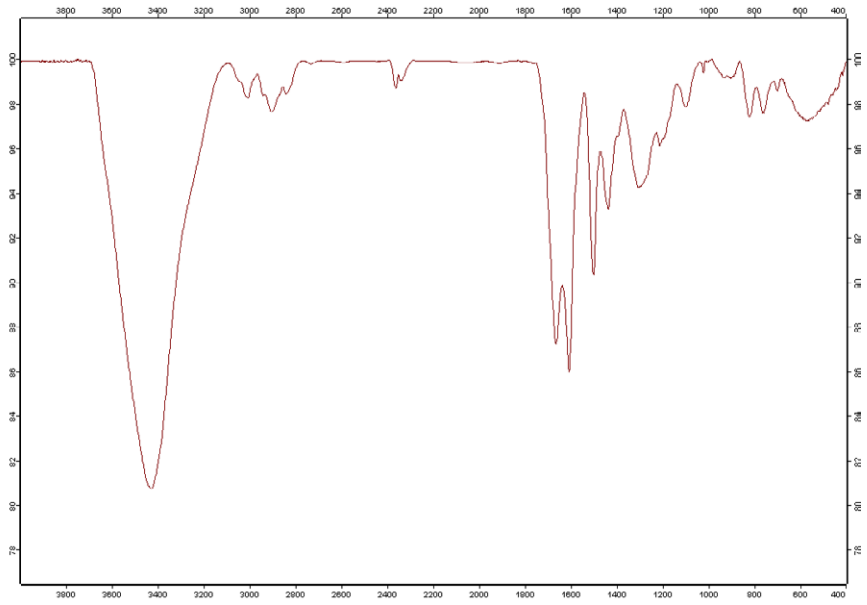

Fig. S2.4 FTIR spectrum of 30 % Aniline

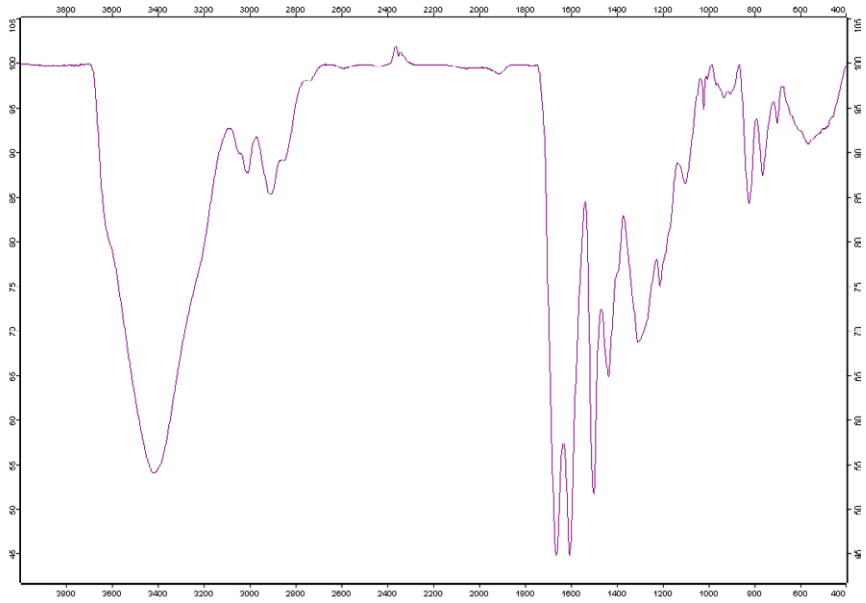

Fig. S2.5 FTIR spectrum of 40 % Aniline

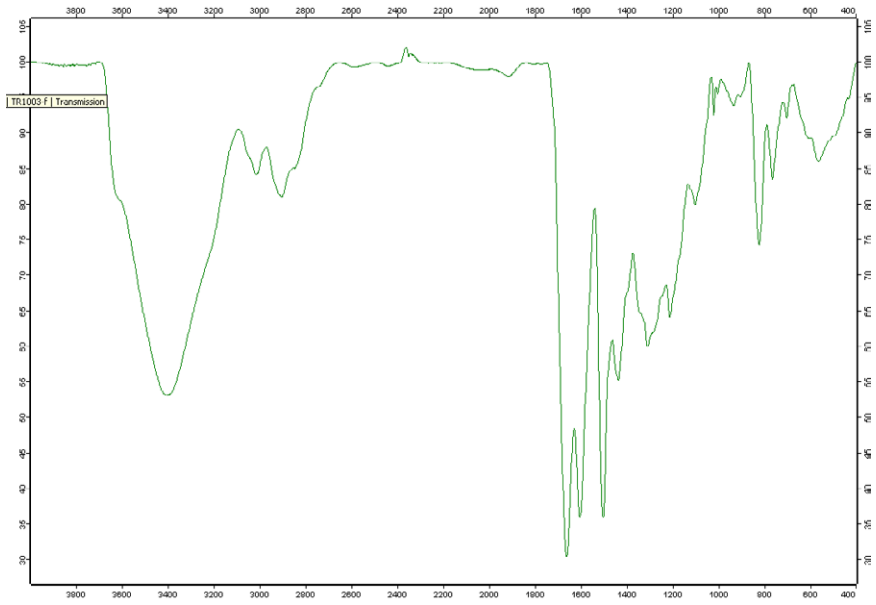

Fig. S2.6 FTIR spectrum of 50 % Aniline

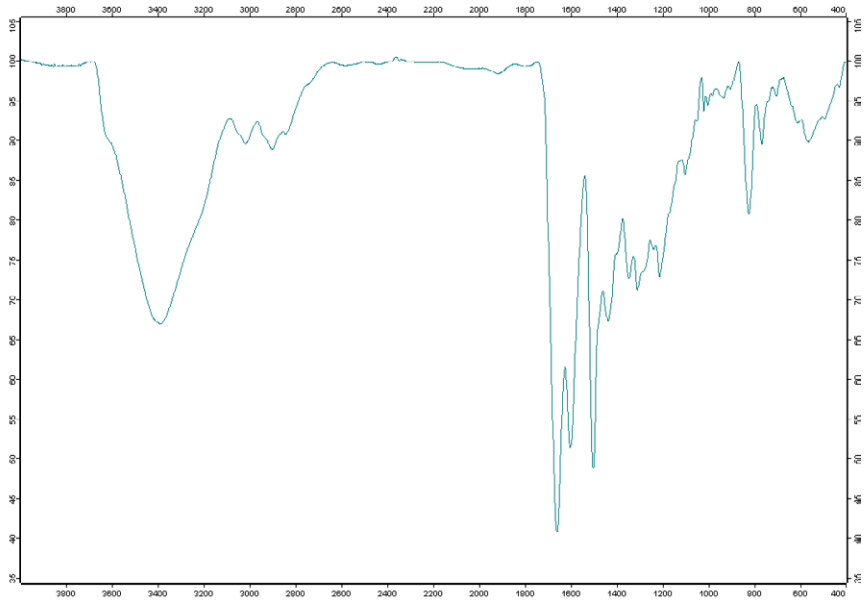

Fig. S2.7 FTIR spectrum of 60 % Aniline

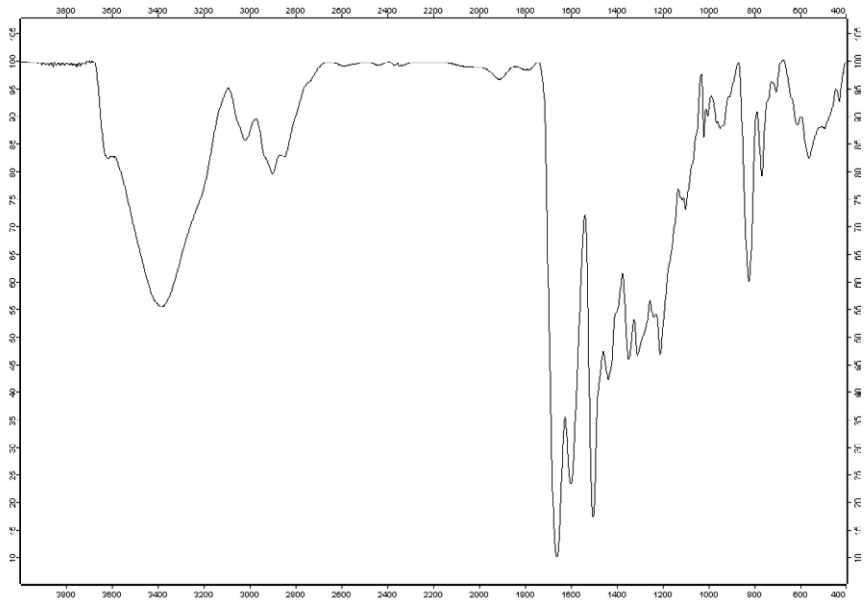

Fig. S2.8 FTIR spectrum of 70 % Aniline

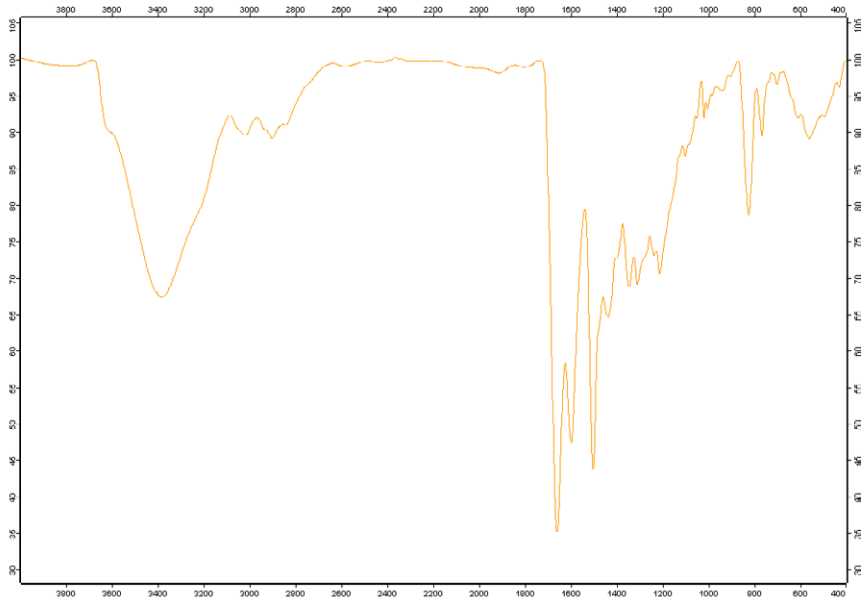

Fig. S2.9 FTIR spectrum of 80 % Aniline

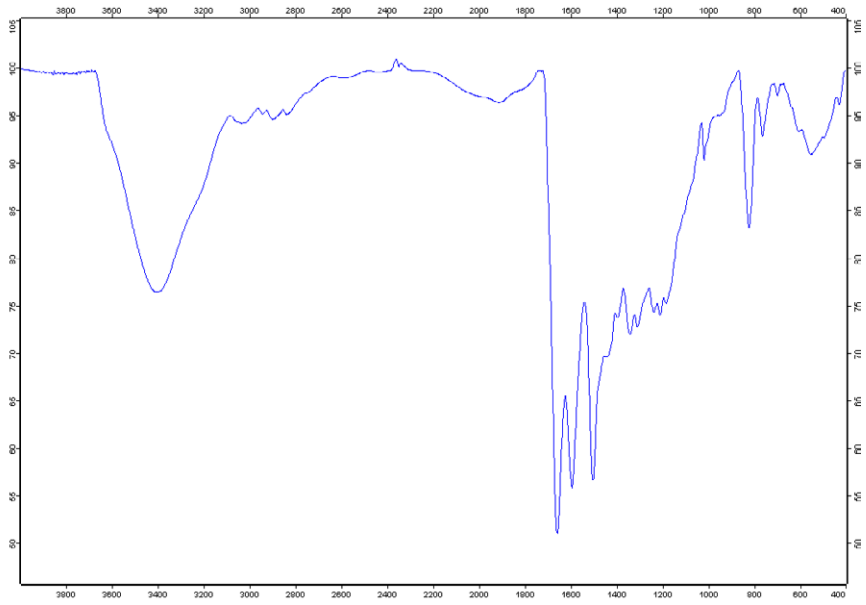

Fig. S2.10 FTIR spectrum of 90 % Aniline

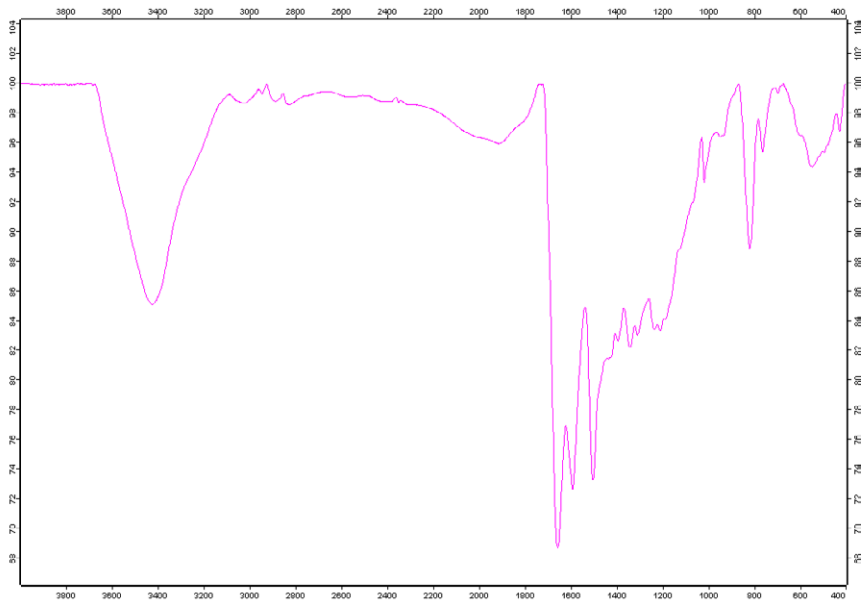

Fig. S2.11 FTIR spectrum of 100 % Aniline

3. BET plots

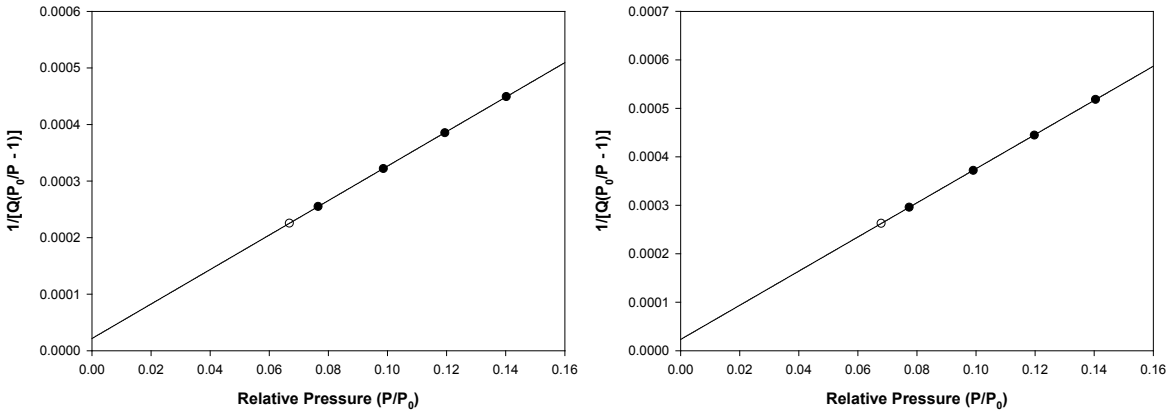

Figure 3.1 BET plots of 0 % (left) and 10 % Aniline (right) networks

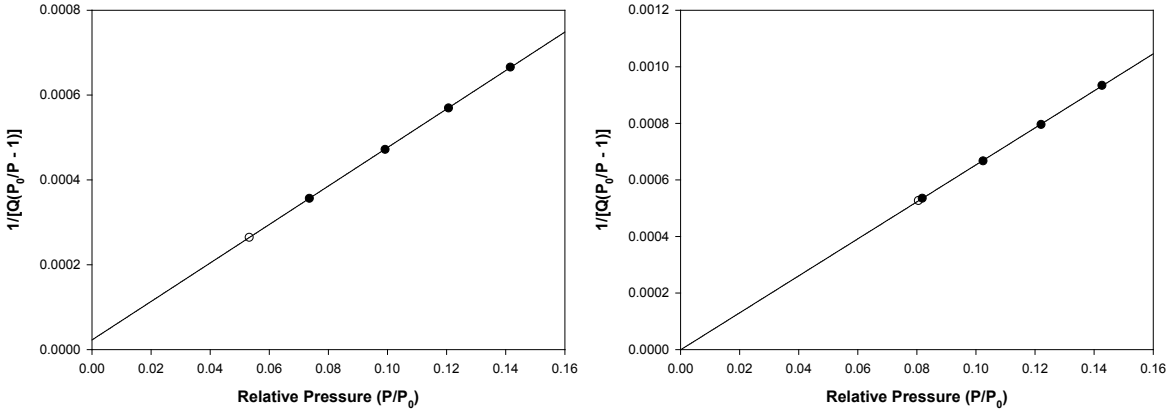

Figure 3.2 BET plots of 20 % (left) and 30 % Aniline (right) networks

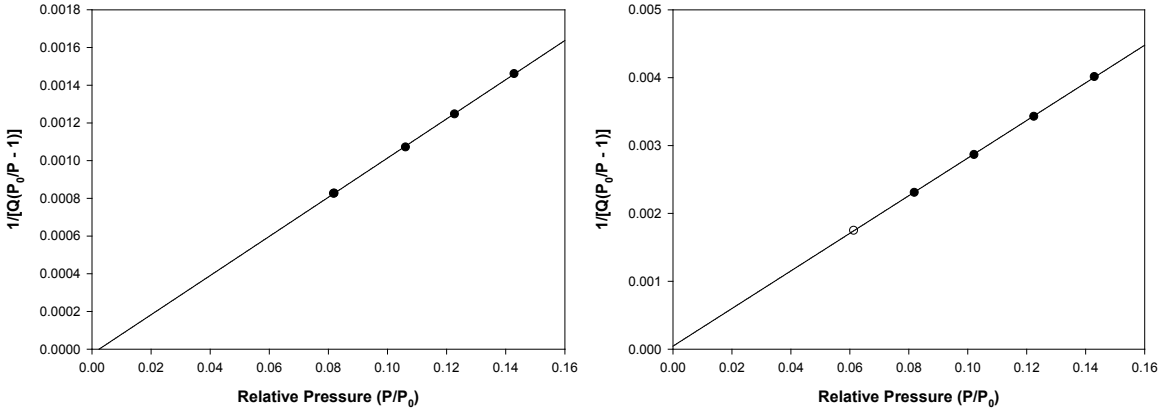

Figure 3.3 BET plots of 40 % (left) and 50 % Aniline (right) networks

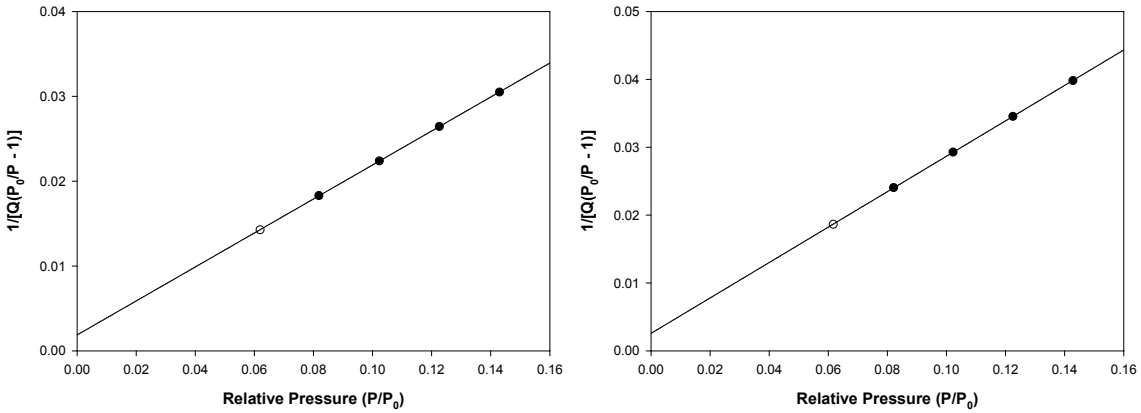

Figure 3.4 BET plots of 60 % (left) and 70 % Aniline (right) networks

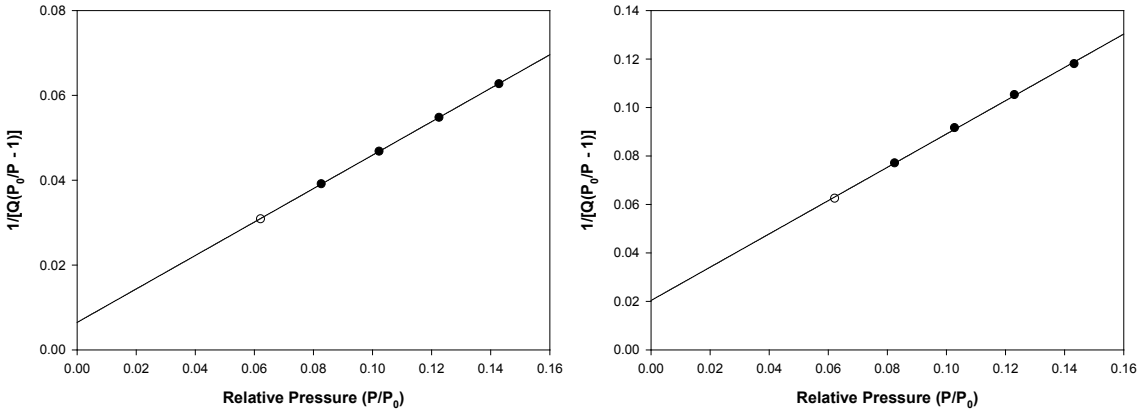

Figure 3.5 BET plots of 80 % (left) and 90 % Aniline (right) networks

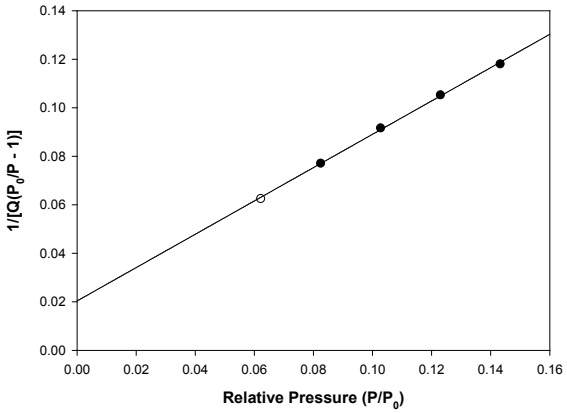

Figure 3.6 BET plots of 100 % Aniline network

4. CO_2 uptakes and CO_2/N_2 selectivity

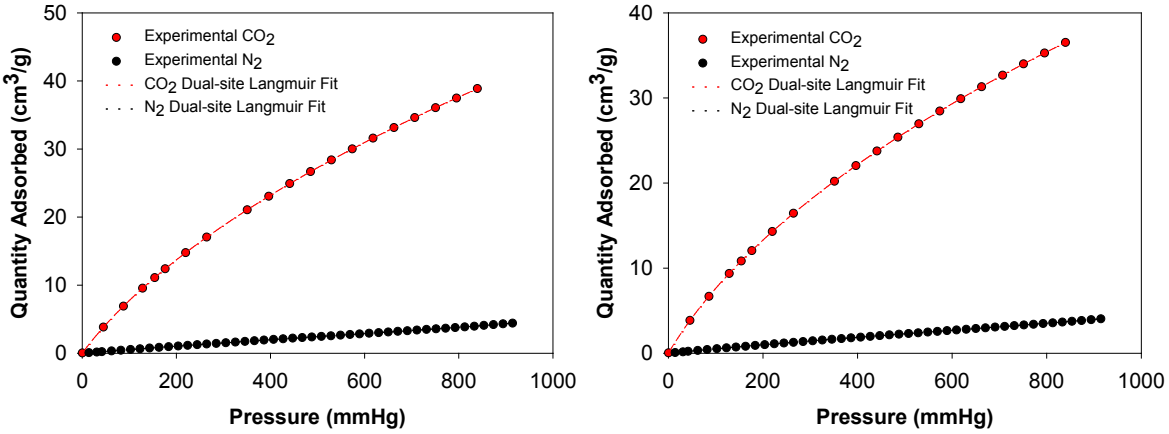

Figure 4.1 CO_2 and N_2 uptakes of 0 % (left) and 10 % Aniline (right) networks at 300 K

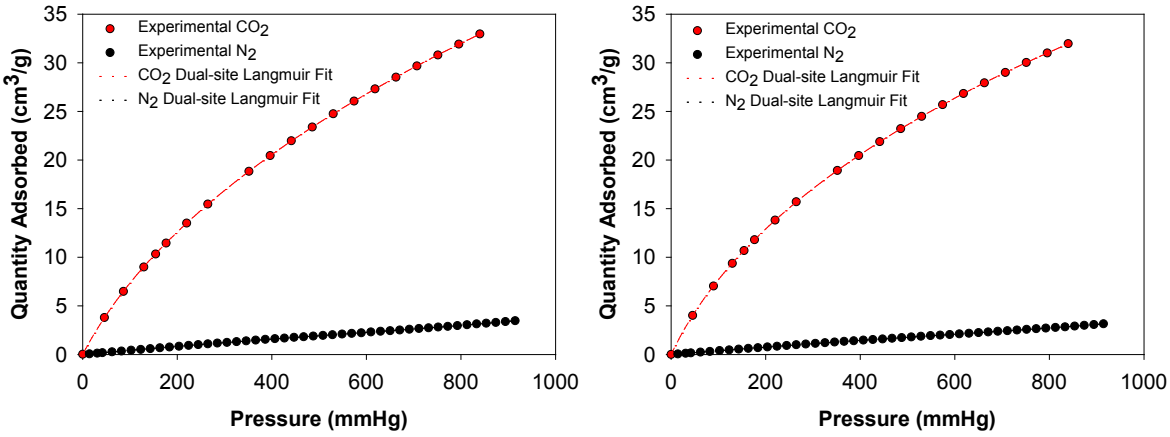

Figure 4.2 CO_2 and N_2 uptakes of 20 % (left) and 30 % Aniline (right) networks at 300 K

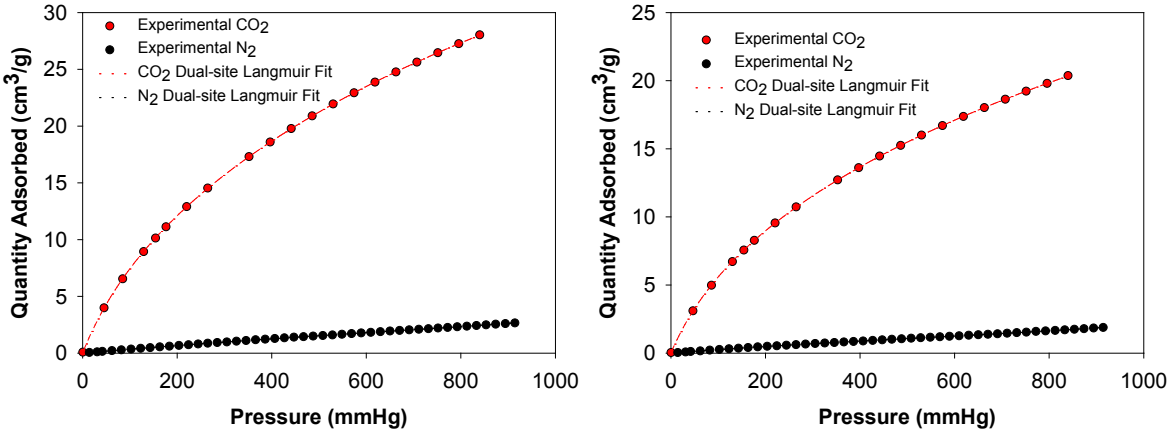

Figure 4.3 CO_2 and N_2 uptakes of 40 % (left) and 50 % Aniline (right) networks at 300 K

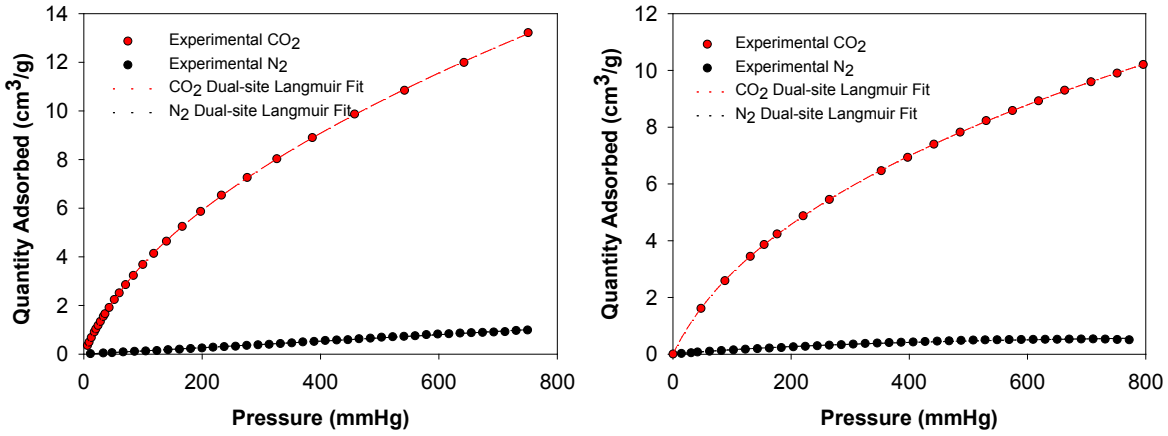

Figure 4.4 CO_2 and N_2 uptakes of 60 % (left) and 70 % Aniline (right) networks at 300 K

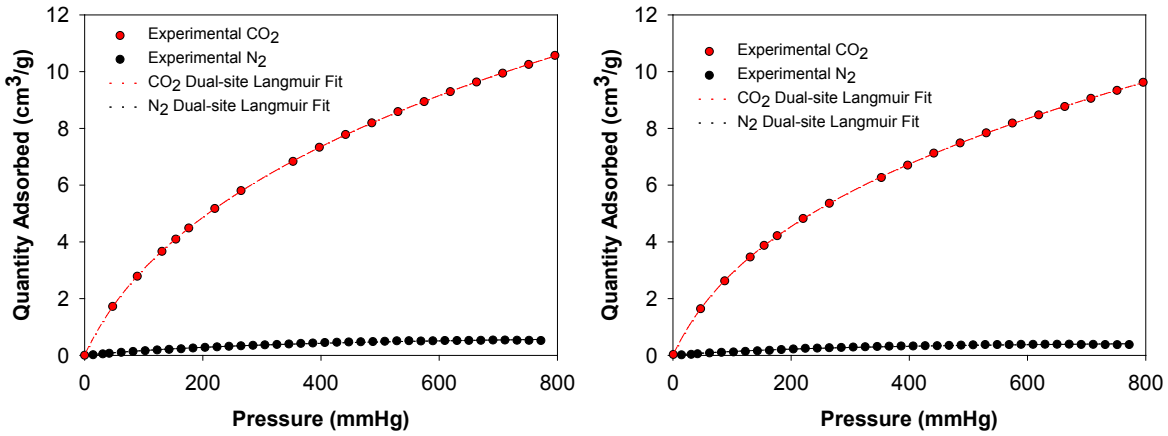

Figure 4.5 CO_2 and N_2 uptakes of 80 % (left) and 90 % Aniline (right) networks at 300 K

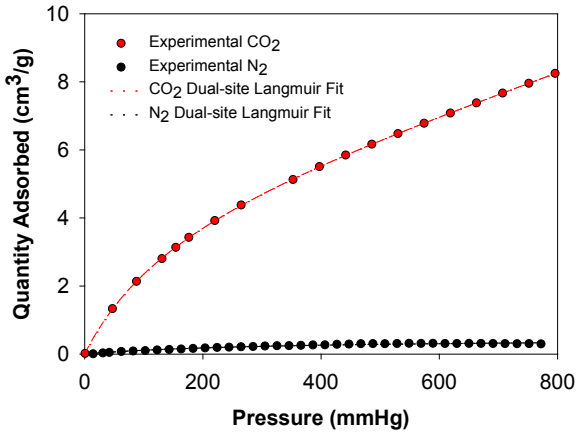

Figure 4.6 CO_2 and N_2 uptakes of 100 % Aniline network at 300 K

5. Benzene/aniline polymer mixtures

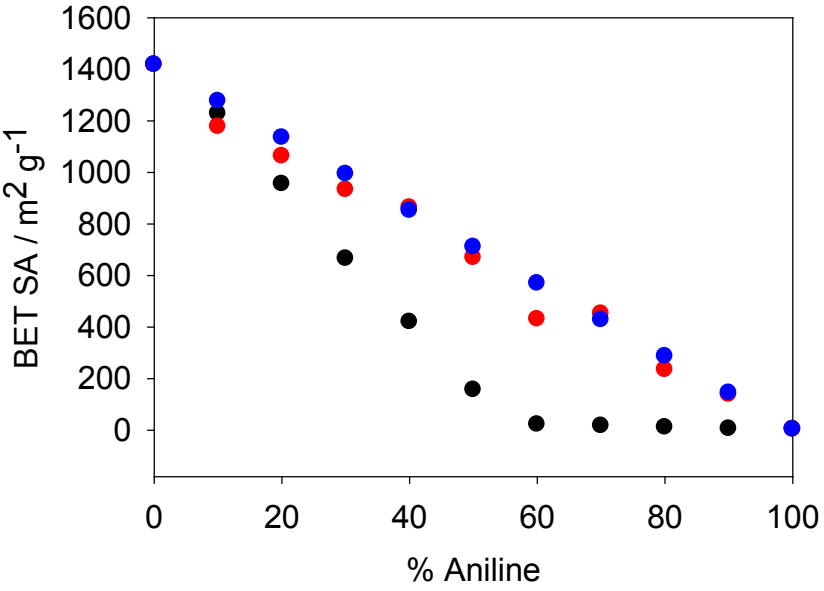

Figure 5 BET surface areas for copolymers (black data), physical admixtures of pure aniline and pure benzene networks (red data) and expected data calculated from the BET surface areas of the pure benzene and pure aniline networks (blue data).

6. Solid state NMR

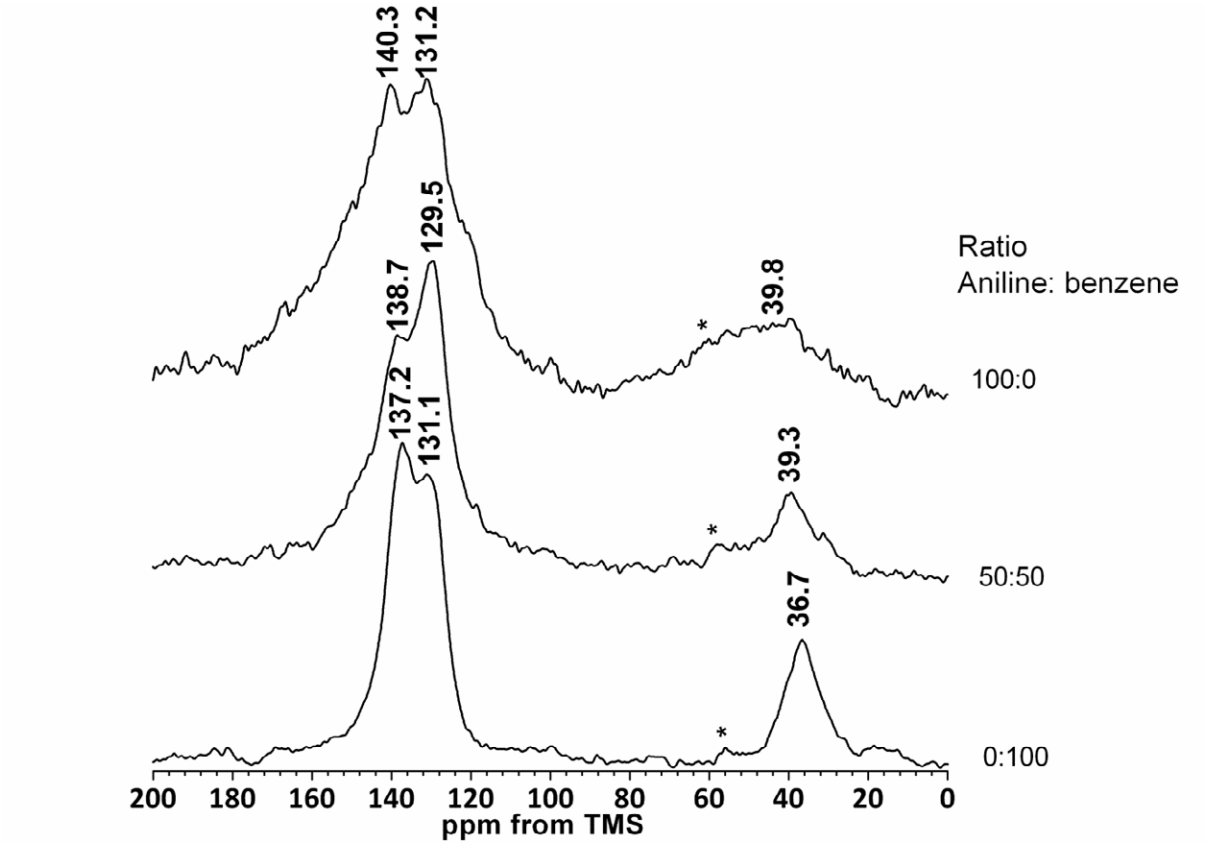

Figure 6 ^{13}C {^{1}H} MAS solid-state NMR spectra of networks. Spectra recorded at an MAS rate of 10 kHz. Asterisks denote spinning sidebands. Chemical shifts are given in ppm.

7. NL-DFT pore size distributions

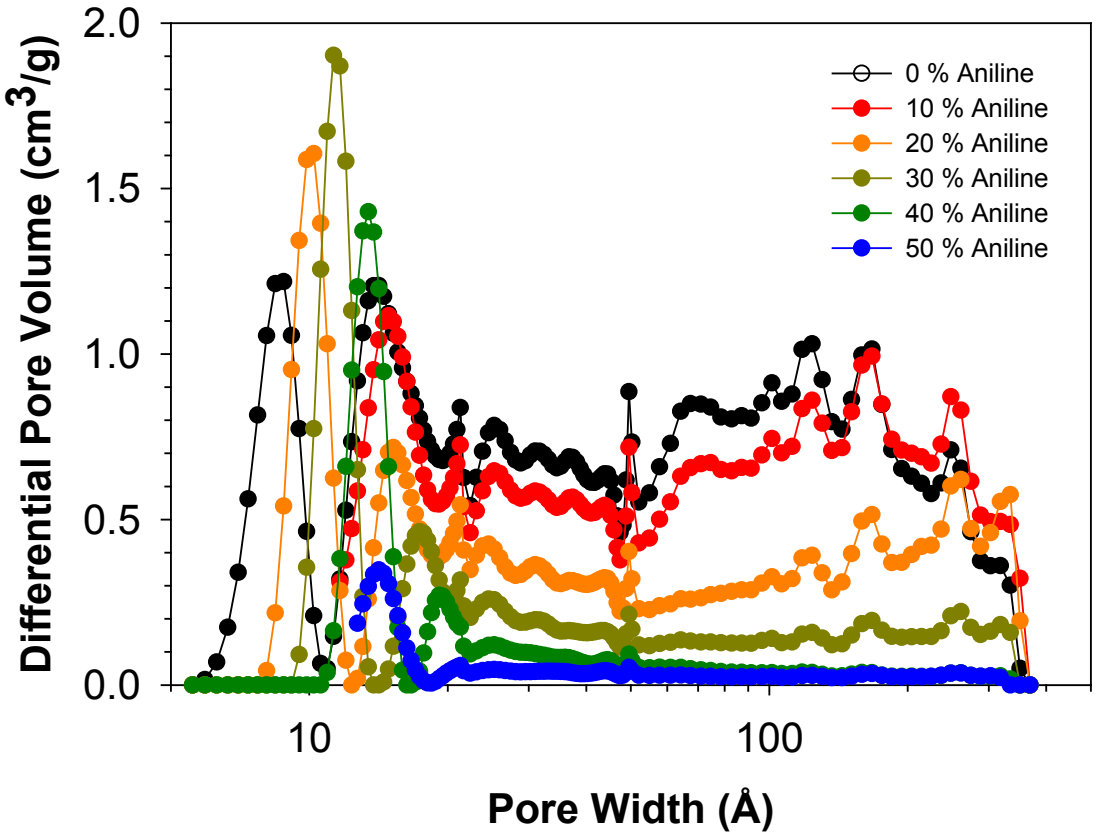

Figure 7 NL-DFT pore size distrubutions for 0 – 50 % Aniline networks calculated using a cylindrical pore model for Pillared Clay.

Table 7 Surface area and pore volume analysis

% Aniline	Average S_{BET} (m^2/g)	V_{tot} (cm^3/g)	$V_{0.1}$ (cm^3/g)	$V_{0.1/tot}$
0	1289 ± 156	1.47	0.52	0.35
10	1097 ± 123	1.27	0.45	0.35
20	757 ± 181	1.31	0.35	0.27
30	481 ± 209	0.65	0.26	0.40
40	238 ± 161	0.26	0.16	0.62
50	152 ± 142	0.13	0.05	0.38