

Investigation of Mechanical, Chemical and Adsorptive Properties of Novel Silicon-Based Adsorbents with Activated Carbon Structure

Christian Bläker, Stefanie Heib, Christoph Pasel, Burak Atakan and Dieter Bathen

Table S1. Adsorption isotherms of acetone (measuring data).

C40/4		C40/4 973.15 K		C40/4 1098.15 K		A35/4		A35/4 973.15 K		A35/4 1098.15 K	
P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)
0.11	4.39	0.11	4.92	0.11	4.67	0.11	4.80	0.11	5.13	0.11	3.13
0.22	4.97	0.22	6.18	0.22	5.48	0.22	6.48	0.22	6.09	0.22	4.13
0.35	5.15	0.35	6.80	0.35	5.76	0.35	7.46	0.35	6.35	0.35	5.04
0.52	5.26	0.52	7.03	0.52	5.89	0.52	7.78	0.52	6.45	0.52	5.81
0.63	5.29	0.63	7.11	0.63	5.93	0.63	7.87	0.63	6.48	0.63	5.97
0.78	5.34	0.78	7.17	0.78	6.01	0.78	7.96	0.78	6.53	0.78	6.08

Table S2. Adsorption isotherms (Langmuir parameter).

	Acetone		Ethanol		Toluene	
	b (T)	X_{mon} (T) ($\mu\text{mol}/\text{m}^2$)	b (T)	X_{mon} (T) ($\mu\text{mol}/\text{m}^2$)	b (T)	X_{mon} (T) ($\mu\text{mol}/\text{m}^2$)
C40/4	0.000,152	5.555	0.000,073	8.895	0.001,239	6.004
C40/4 973.15 K	0.000,070	7.904	0.000,302	9.091	0.002,094	4.770
C40/4 1098.15 K	0.000,115	6.342	0.000,314	8.616	0.000,943	5.342
A35/4	0.000,047	9.194	0.000,120	11.991	0.002,362	5.543
A35/4 973.15 K	0.000,025	7.353	0.000,278	9.318	0.002,112	3.831
A35/4 1098.15 K	0.000,136	6.918	0.000,971	5.004	0.001,286	4.402

Table S3. Adsorption isotherms of ethanol (measuring data).

C40/4		C40/4 973.15 K		C40/4 1098.15 K		A35/4		A35/4 973.15 K		A35/4 1098.15 K	
P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)
0.09	3.31	0.08	5.13	0.09	5.36	0.06	4.08	0.06	4.97	0.06	4.28
0.19	4.46	0.17	6.64	0.18	6.70	0.12	6.32	0.12	6.69	0.12	5.73
0.37	6.04	0.33	7.52	0.40	7.37	0.19	7.69	0.19	7.51	0.19	6.21
0.42	6.18	0.37	7.59			0.28	8.72	0.28	7.93	0.28	6.69
0.56	6.47	0.50	7.76			0.34	8.98	0.34	8.04	0.34	6.86
						0.42	9.46	0.42	8.25	0.42	7.12
						0.56	10.10	0.56	8.66	0.56	7.83

Table S4. Adsorption isotherms of toluene (measuring data).

C40/4		C40/4 973.15 K		C40/4 1098.15 K		A35/4		A35/4 973.15 K		A35/4 1098.15 K	
P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)	P/P ₀	Load ($\mu\text{mol}/\text{m}^2$)
4.25	0.08	3.91	0.08	3.50	0.08	4.52	0.08	3.32	0.08	3.23	4.25
5.10	0.15	4.34	0.15	4.33	0.15	5.05	0.15	3.67	0.15	3.91	5.10
5.36	0.23	4.46	0.23	4.63	0.23	5.19	0.23	3.76	0.23	4.01	5.36
5.51	0.35	4.54	0.35	4.79	0.35	5.29	0.35	3.89	0.35	4.17	5.51
5.57	0.42	4.58	0.42	4.87	0.42	5.34	0.42	3.90	0.42	4.21	5.57
5.66	0.53	4.64	0.53	4.97	0.53	5.40	0.53	4.00	0.53	4.27	5.66

Table S5. Fluidized bed abrasion test (measuring data).

C40/4		C40/4 1098.15 K	
Time (h)	Abrasion (g/100 g)	Time (h)	Abrasion (g/100 g)
0.08	3.28	0.08	0.04
0.17	4.85	0.25	0.08
0.25	5.40	0.50	0.13
0.50	7.93	1.00	0.25
1.00	10.68	2.00	0.52
2.00	17.30	3.00	0.74
3.00	21.77	4.00	0.94
4.00	28.17	5.00	1.21
5.00	34.80	6.00	1.44
6.00	39.87		

Table S6. Excess isotherms of acetone-toluene at 298.15 K (measuring data).

A35/4		A35/4 HNO ₃		A35/4 973.15 K		A35/4 973.15 K HNO ₃		A35/4 1098.15 K		A35/4 1098.15 K HNO ₃	
X _{Toluol}	Γ_{Toluol} (mmol/g)	X _{Toluol}	Γ_{Toluol} (mmol/g)	X _{Toluol}	Γ_{Toluol} (mmol/g)	X _{Toluol}	Γ_{Toluol} (mmol/g)	X _{Toluol}	Γ_{Toluol} (mmol/g)	X _{Toluol}	Γ_{Toluol} (mmol/g)
0.01	0.44	0.01	0.47	0.02	0.35	0.02	0.29	0.01	0.36	0.02	0.41
0.04	0.75	0.04	0.73	0.04	0.59	0.04	0.43	0.04	0.66	0.04	0.61
0.08	1.21	0.07	0.93	0.14	0.92	0.09	0.54	0.09	0.93	0.08	0.76
0.13	1.36	0.13	0.97	0.19	0.75	0.14	0.50	0.13	1.08	0.13	0.72
0.18	1.47	0.18	0.93	0.26	0.54	0.19	0.44	0.18	1.12	0.18	0.77
0.26	1.40	0.28	0.73	0.40	0.22	0.29	0.17	0.28	1.13	0.29	0.49
0.37	1.28	0.39	0.35	0.45	0.07	0.40	-0.14	0.38	0.82	0.40	0.27
0.42	1.11	0.45	0.09	0.51	-0.09	0.46	-0.40	0.43	0.89	0.45	0.02
0.48	0.86	0.50	-0.10	0.56	-0.23	0.52	-0.65	0.48	0.68	0.51	-0.13
0.53	0.80	0.62	-0.60	0.62	-0.39	0.63	-0.94	0.53	0.63	0.56	-0.20
0.58	0.62	0.72	-0.85	0.71	-0.60	0.72	-1.16	0.59	0.51	0.61	-0.29
0.69	0.16	0.83	-0.91	0.87	-0.78	0.84	-1.60	0.70	0.10	0.72	-0.72
0.80	-0.01	0.88	-0.92	0.92	-0.76	0.88	-1.36	0.80	-0.04	0.82	-0.97
0.82	-0.05	0.92	-0.90	0.96	-0.61	0.93	-1.26	0.85	-0.10	0.87	-0.78
0.91	-0.16	0.96	-0.63	0.99	-0.39	0.97	-0.70	0.90	-0.33	0.92	-0.70
0.95	-0.12	0.99	-0.45			0.99	-0.20	0.95	-0.18	0.96	-0.58
0.96	-0.07							0.98	-0.11	0.98	-0.40

Table S7. Excess isotherms of acetone-toluene at 298.15 K (Redlich-Kister parameter).

	C40/4	C40/4 973.15 K	C40/4 1098.15 K	A35/4	A35/4 973.15 K	A35/4 1098.15 K
C1	3.27	-0.23	-0.07	-1.90	2.86	-0.12
C2	-4.27	-8.16	-5.27	-4.71	-2.67	-5.39
C3	-4.68	-9.89	-5.93	-3.69	-4.86	-7.34
C4	-0.59	-7.00	-10.01	-14.02	-2.97	-9.27
k	0.91	0.85	0.59	0.00	0.87	0.67