Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics

Supplementary Information

Pore size distribution and capacitance in microporous carbons

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Table S1. Structural and electrochemical properties of the carbons. The average pore size L_{av} corresponds to the range of 0.7 to 2.0 nm of the NLDFT pore size distributions, and $S_{tot\ NLDFT}$ is the total area above 0.7 nm, accessible to the $(C_2H_5)_4N^+$ ion (0.68 nm).

Carbon	L_{av} nm	$S_{tot\ NLDFT}$ $m^2\ g^{-1}$	$S_{e\ NLDFT}$ $m^2\ g^{-1}$	$S_{mi\ NLDFT}$ $m^2\ g^{-1}$	C_{total} $F\ g^{-1}$	C_{mi} $F\ g^{-1}$	$(C/S)_{tot}$ $F\ m^{-2}$	$(C/S)_{mi}$ $F\ m^{-2}$	$(C/S)_{mi}$ Eqn (1) $F\ m^{-2}$
CMS	0.81	570	8	562	55	54.3	0.096	0.097	0.132
HK-650-8	0.84	522	15	507	40	38.6	0.078	0.076	0.134
PAU-1	0.85	975	7	968	75	74.3	0.077	0.077	0.135
SiC-800	0.85	1064	17	1047	93	91.4	0.087	0.087	0.134
TiC-600	0.86	1168	6	1162	119	118.4	0.102	0.102	0.139
RM-1	0.87	801	0	801	87	87.0	0.109	0.109	0.136
PAU-1-950	0.87	848	26	822	93	90.6	0.110	0.110	0.135
AC-507-17	0.88	1098	1	1098	95	95.0	0.087	0.087	0.136
CEP-2008	0.95	976	65	911	90	83.9	0.092	0.092	0.133
M2	0.97	981	20	961	97	95.0	0.099	0.099	0.132
TiC-TiO2	1.02	1416	45	1371	128	124.0	0.090	0.090	0.132
DCG-5	1.04	918	57	861	83	77.6	0.090	0.090	0.131
M1R-950	1.08	1137	24	1113	90	87.7	0.079	0.079	0.133
BCKA	1.08	1132	30	1102	92	89.2	0.081	0.081	0.130
KF-1500	1.12	1187	75	1112	107	99.9	0.090	0.090	0.128
F-02	1.12	942	48	894	89	84.5	0.095	0.094	0.129
M1-R	1.15	1037	37	1000	91	87.5	0.088	0.088	0.127
N-125	1.17	928	74	854	83	76.0	0.089	0.089	0.127
PC-94-11	1.2	779	5	774	80	79.5	0.103	0.103	0.125
U03	1.26	642	80	562	66.5	59.0	0.104	0.105	0.124
U02-ox	1.33	560	84	472	58	50.0	0.104	0.106	0.118

Below, we show typical NLDFT-based PSDs of cabons of the present series, which are predominantly nanoporous. The gap in the PSDs, observed near 1 nm for many carbons (but not all), is a known characteristic of NLDFT, but less relatively small. With respect to the values of Table S1, the smoothing of the PSD over this gap leads to an increase in the area $S_{mi\ NLDFT}$ typically between 3 and 10 percent (see Table S2, below). This does not modify significantly the overall picture reported in this paper, namely the absence of a clear trend in $(C/S)_{mi}$, nor the fact that the PSDs do not hide significant variations of C/S given by dC/ds and shown in Fig. 1.

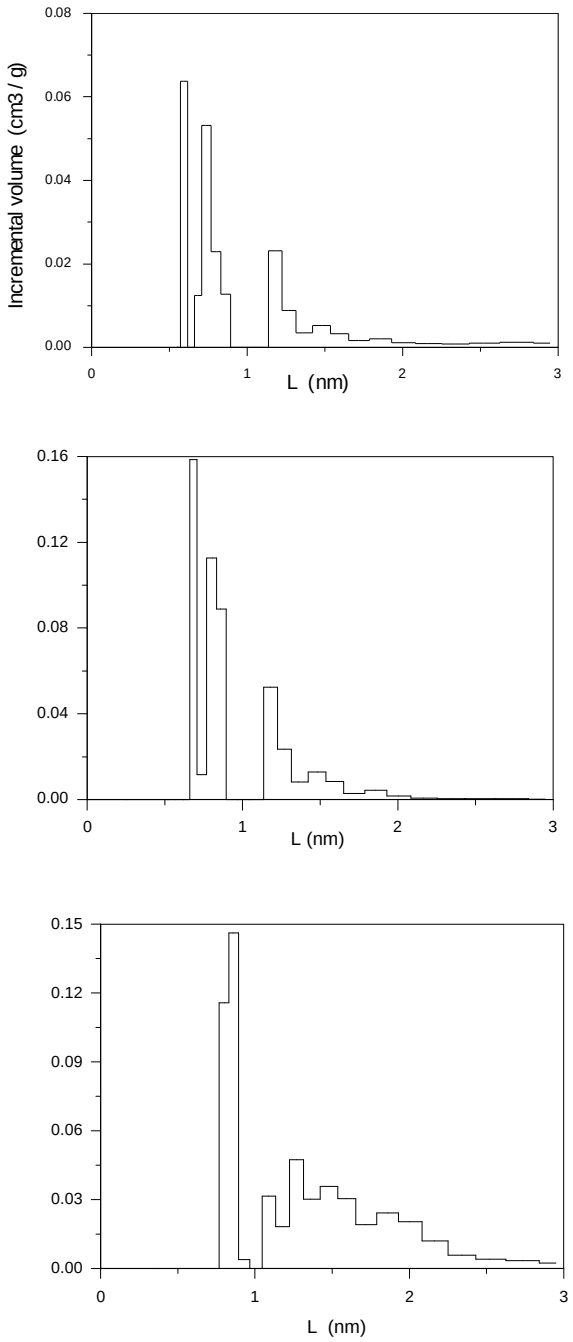

Fig. S1. Typical NLDFT-based pore size distributions for nitrogen adsorption at 77 K. Samples CMS (top), TiC-600 (middle) and M1-R (bottom). The latter displays some porosity between 2 and 3 nm, with an area of 24 $m^2\ g^{-1}$. Its contribution to C is assumed to be 0.094 F m^{-2}, as for the entire external surface area (37 $m^2\ g^{-1}$), but in any case the correction leading to C_{mi} is relatively small. Moreover, if one considers the porosity up to 3 nm, L_{av} increases only from 1.15 to 1.20 nm.

Table S2. Comparison of specific capacitances C/S in micropores between 0.7 and 1.3 nm, by using (a) the original NLDFT PSDs with a gap around 1 nm, leading to $(C/S)_{mi}$, and (b) by adding the estimated area of the gap $S_{gap\ NLDFT}$, which leads to $(C/S)_{mi\ +\ gap}$. Neither series shows a definite trend with respect to L_{av} and the respective averages are 0.093 ± 0.010 F m^{-2} and 0.087 ± 0.010 F m^{-2}. No reliable correction could be applied in the case of the shredded PSDs of carbons (8) and (19). Carbons (2)(6)(11) and (12) show no gaps in their PSDs.

Carbon	L_{av} nm	$S_{mi\ NLDFT}$ $m^2\ g^{-1}$	$S_{gap\ NLDFT}$ $m^2\ g^{-1}$	$S_{mi\ +\ gap}$ $m^2\ g^{-1}$	C_{mi} F g^{-1}	$(C/S)_{mi}$ F m^{-2}	$(C/S)_{mi\ +\ gap}$ F m^{-2}
1 CMS	0.81	562	35	597	54.3	0.097	0.091
2 HK-650-8	0.84	507	0	507	38.6	0.076	0.076
3 PAU-1	0.85	968	40	1008	74.3	0.077	0.074
4 SiC-800	0.85	1047	10	1057	91.4	0.087	0.086
5 TiC-600	0.86	1162	148	1310	118.4	0.102	0.090
6 RM-1	0.87	801	0	801	87.0	0.109	0.109
7 PAU-1-950	0.87	822	25	847	90.6	0.110	0.107
8 AC-507-17	0.88	1098	-	-	95.0	0.087	-
9 CEP-2008	0.95	911	31	942	83.9	0.092	0.089
10 M2	0.97	961	27	988	95.0	0.099	0.096
11 TiC-TiO2	1.02	1371	0	1371	124.0	0.090	0.090
12 DCG-5	1.04	861	0	861	77.6	0.090	0.090
13 M1R-950	1.08	1113	87	1200	87.7	0.079	0.073
14 BCKA	1.08	1102	34	1136	89.2	0.081	0.079
15 KF-1500	1.12	1112	86	1198	99.9	0.090	0.083
16 F-02	1.12	894	35	929	84.5	0.094	0.091
17 M1-R	1.15	1000	33	1033	87.5	0.088	0.085
18 N-125	1.17	854	21	875	76.0	0.089	0.087
19 PC-94-11	1.2	774	-	-	79.5	0.103	-
20 U03	1.26	562	196	758	59.0	0.105	0.078
21 U02-ox	1.33	472	112	584	50.0	0.106	0.086