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Supporting Information

Electrochemical Capacitance and Ionic Transport in the Mesoporous Shell of a Hierarchical Porous Core-Shell Carbon Structure

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Symbols used in the calculations:

C: Diameter of hollow core;

S: Shell thickness;

V_C: Volume of hollow core region;

V_S: Volume of shell region;

V_I: Volume of interstitial region.

V_{S+C}: Volume of shell and hollow core regions, $V_{S+C} = V_S + V_C$.

Total volume of an fcc pattern: $V_t = V_I + V_{S+C}$.

According to an fcc pattern, the volumetric fractions of different regions can be estimated as following:

$V_{S+C}/V_t = 0.74$, $V_I/V_t = 0.26$

$V_C/V_t = [C/(C+S)]^3 \times 0.74$

$V_S/V_t = 0.74 - V_C/V_t$

Using the above equations, the fractions can be obtained as shown in the table.

Samples	*0.5C* / nm	(0.5*C*+*S*) / nm	V_C/V_t	V_S/V_t	V_I/V_t
C-CS0	165	165	0.74	0	0.26
C-CS50	165	190	0.48	0.26	0.26
C-CS80	165	215	0.33	0.41	0.26
C-CS150	165	265	0.18	0.56	0.26

Sample calculation: Take 350C-50S as an example:

The density of carbon was considered as 1.79 g / cm^3,[1] then, 1 g of carbon has a volume of 0.56 cm^3. Pore volume from N_2 sorption was integrated from the PSD based on BJH method, 1.10 cm^3/g.

Total volume of 1.0 g porous carbon including solid carbon, mesopores and hollow macro-cores:

(Pore volume + Volume of solid carbon) / (1 - Fraction of hollow core region)
= (1.10 cm^3 + 0.56 cm^3) / (1 – 0.48) = 3.19 cm^3

Volume of hollow cores:

Total volume of 1.0 g porous carbon × Fraction of hollow core region
= 3.19 × 0.48 = 1.53 cm^3

Total Void of Pore volume from N_2 sorption and calculated macro-core volume:

Pore volume from N_2 sorption + Volume of hollow cores
= 1.10 cm^3/g + 1.53 cm^3 = 2.63 cm^3

Reference:

1. M. A. Capano, N. T. McDevitt, R. K. Singh and F. Qian, *J. Vac. Sci. Technol. A*, 1996, **14**, 431-435.