

# Exploring the Impact of DAHP Impregnation on Activated Carbon Fibers for Efficient Charge Storage and Selective O<sub>2</sub> Reduction to Peroxide

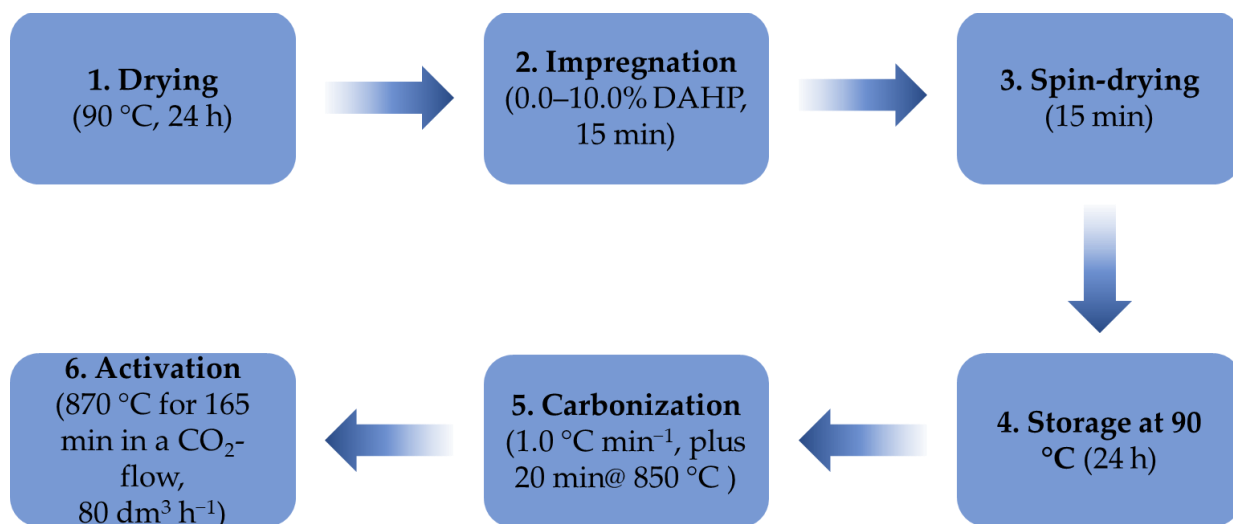
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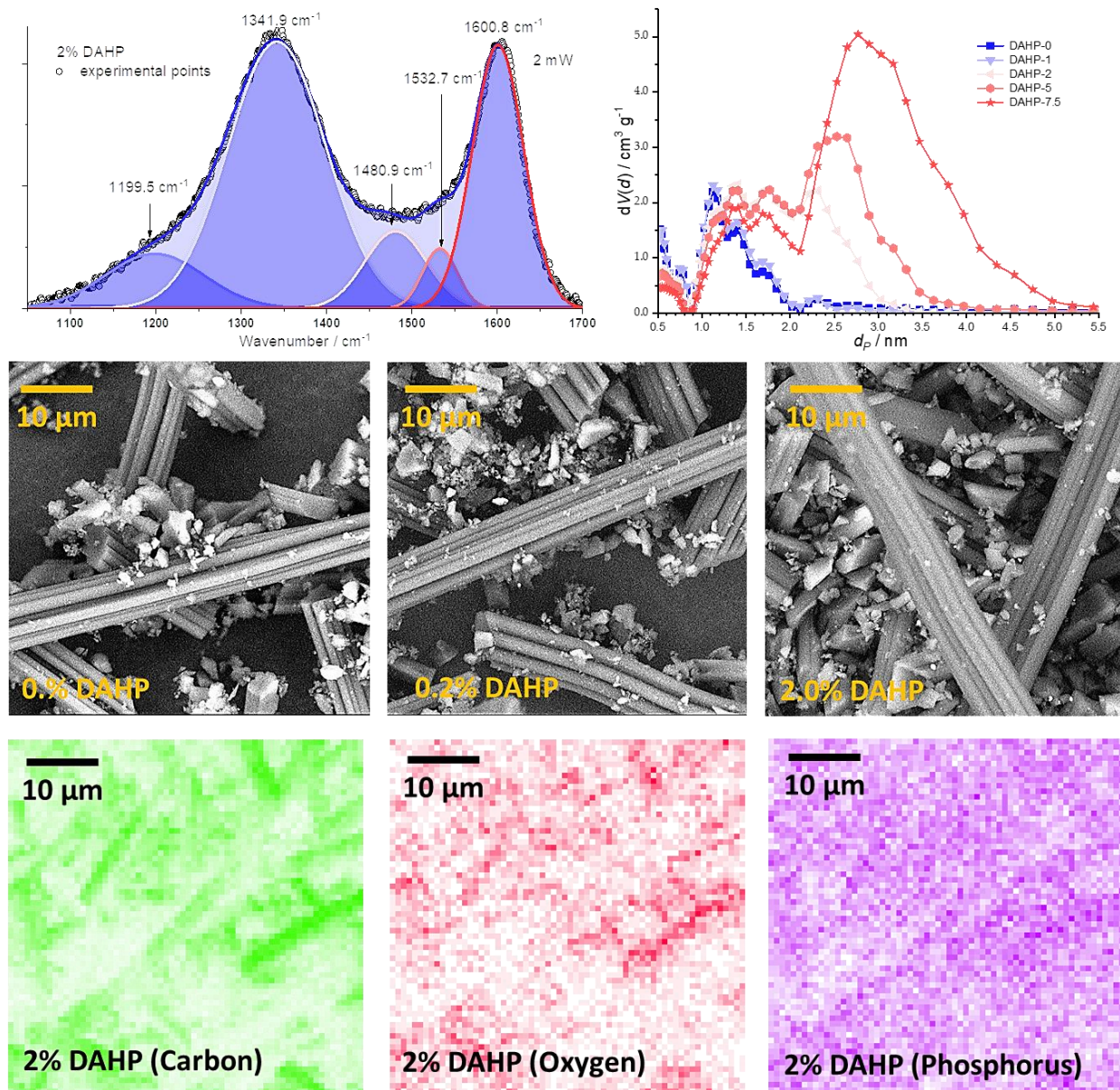
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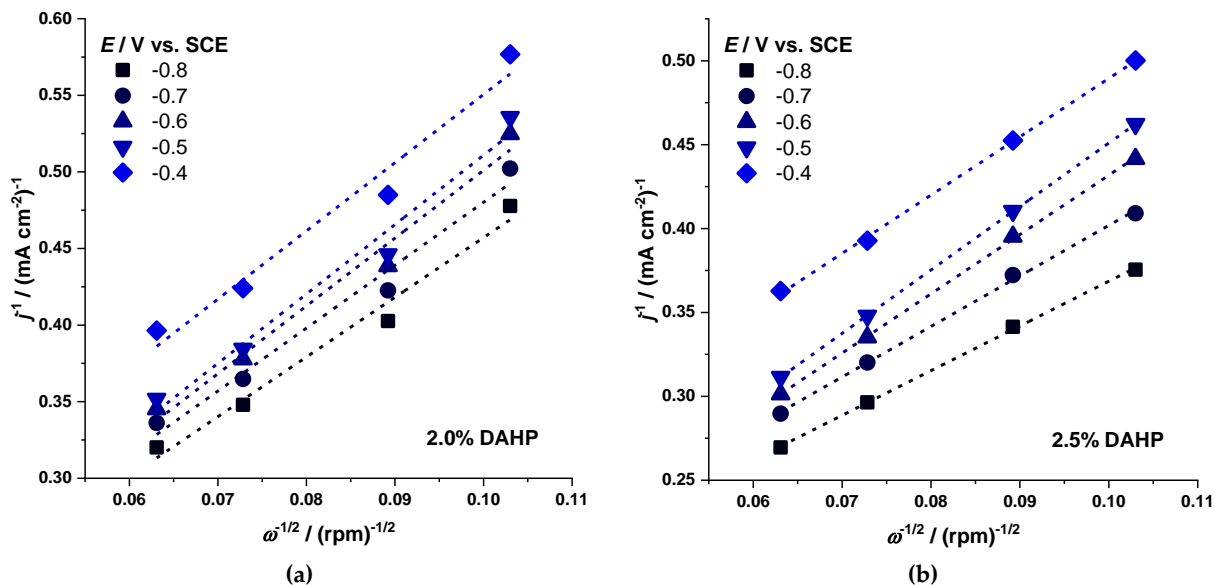
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**Scheme S1.** The block synthesis workflow for the DAHP-X samples.



**Figure S1.** The representative results of the physical and chemical characterization of the studied samples: top row – Raman spectrum and Pore Size Distribution for selected samples, middle row – Scanning Electron Microscopy Analysis, bottom row – EDX mapping for the sample 2% DAHP.



**Figure S2.** Representative Koutecky-Levich plots of studied ACF samples: (a) sample 2.0% DAHP, (b) sample 2.5% DAHP.

**Table S1.** Measured capacitances (F g<sup>-1</sup>) in H<sub>2</sub>SO<sub>4</sub> solution at different scan rates

<b>material</b>	<b>5 mV s<sup>-1</sup></b>	<b>10 mV s<sup>-1</sup></b>	<b>20 mV s<sup>-1</sup></b>	<b>50 mV s<sup>-1</sup></b>	<b>100 mV s<sup>-1</sup></b>	<b>200 mV s<sup>-1</sup></b>	<b>400 mV s<sup>-1</sup></b>
<b>0.0 % DAHP</b>	48.9±3.9	51.0±4.6	57.5±5.2	60.0±4.2	53.3±3.7	50.8±2.5	46.3±4.2
<b>0.25 % DAHP</b>	61.9±5.6	60.2±3.6	59.8±4.8	56.7±3.4	48.2±2.9	42.7±3.0	36.1±2.5
<b>0.5 % DAHP</b>	44.3±2.2	44.6±4.0	47.5±2.4	49.0±3.4	42.1±1.7	39.9±2.0	36.4±1.5
<b>1.0 % DAHP</b>	102±5	107.6±6.5	110±6.6	119.9±8.4	113.7±9.1	96.6±3.9	78.6±4.7
<b>1.5 % DAHP</b>	67.3±6.1	74.2±5.9	91.1±3.6	97.7±7.8	90.6±5.4	87.8±6.1	82.4±4.9
<b>2.0 % DAHP</b>	47.1±3.3	59.6±4.8	84±5.9	101.3±7.1	93.6±5.6	95±8.5	92.0±4.6
<b>2.5 % DAHP</b>	88.6±7.1	97.5±3.9	112.6±5.6	118±6	110.1±8.8	106±4.3	98.7±7.9
<b>5.0 % DAHP</b>	47.1±2.4	56.3±3.4	73.2±5.1	84.2±4.2	77.2±3.1	77.9±4.7	74.6±6.0
<b>7.5 % DAHP</b>	39.9±3.6	38.0±2.7	47.2±2.4	56.7±5.1	51.6±4.1	52.2±3.7	50.3±3.5
<b>10.0 % DAHP</b>	97.6±3.9	91.0±8.2	87.2±3.5	85.3±4.3	72.8±2.9	69.5±2.8	64.4±2.6

**Table S2.** Measured capacitances (F g<sup>-1</sup>) in KNO<sub>3</sub> solution at different scan rates

material	5 mV s <sup>-1</sup>	10 mV s <sup>-1</sup>	20 mV s <sup>-1</sup>	50 mV s <sup>-1</sup>	100 mV s <sup>-1</sup>	200 mV s <sup>-1</sup>	400 mV s <sup>-1</sup>
0.0 % DAHP	84.0±2.5	72.9±2.9	66.4±6.0	58.6±3.5	49.3±3.9	43.7±1.3	37.5±2.6
0.25 % DAHP	49.9±2.5	49.9±4.5	51.2±3.1	49.6±1.5	43.4±3.5	38.1±3.0	31.5±1.3
0.5 % DAHP	30.6±2.8	30.5±1.5	35.5±2.5	39.8±2.4	35.7±2.9	34.7±2.8	32.1±2.6
1.0 % DAHP	128±5	116.5±3.5	119.0±6.0	117±3.5	104.6±5.2	98.8±4.0	90.7±5.4
1.5 % DAHP	98.3±4.9	77.5±3.9	79.9±4.8	84.3±5.9	79.4±6.4	77.0±3.1	72.1±2.9
2.0 % DAHP	36.1±2.2	54.1±1.6	76.9±5.4	88±2.6	84.6±6.8	82.7±7.4	83.3±5.0
2.5 % DAHP	52.9±4.8	77.8±7.0	95.8±8.6	102.0±6.1	96.9±8	95±5.7	89.2±4.5
5.0 % DAHP	33.5±2.3	42.7±2.6	60.6±3.0	72.4±2.2	68.0±4.8	70.0±2.1	68.7±4.8
7.5 % DAHP	56.4±3.9	36.5±2.6	36.1±2.9	44.6±1.8	41.2±2.5	42.6±3.0	42.2±2.1
10.0 % DAHP	84.0±7.6	36.7±2.6	46.8±4.2	56.7±2.3	51.7±4.7	53.3±2.1	52.2±1.6

**Table S3.** Calculated ORR mass activities (in A g<sup>-1</sup>)

material	<i>E vs. SCE / V</i>			
	-0.8	-0.7	-0.6	-0.5
0.0 % DAHP	34.1±3.4	37.6±3.0	42.2±3.4	45.1±4.1
0.25 % DAHP	19.3±1.5	17.6±1.8	18.2±1.5	15.3±1.5
0.5 % DAHP	22.2±2.0	19.0±1.7	20.6±1.9	22.8±2.3
1.0 % DAHP	43.5±4.2	44.9±3.6	51.7±4.7	55.3±4.4
1.5 % DAHP	25.7±2.1	23.6±1.9	23.5±2.1	22.2±2.2
2.0 % DAHP	59.2±5.3	57.5±4.6	68.3±6.1	68.9±6.9
2.5 % DAHP	39.1±3.9	39.7±3.6	50.9±4.1	54.9±5.5
5.0 % DAHP	12.7±1.1	12.0±1.2	13.5±1.1	15.3±1.4
7.5 % DAHP	39.8±3.6	38.7±3.1	60.2±6.0	88.5±8.9
10.0 % DAHP	33.5±2.7	34.5±3.1	44.8±4.5	56.7±4.5

**Table S4.** Number of electrons consumed *per* O<sub>2</sub> molecule, calculated at different electrode potentials

material	<i>E vs. SCE / V</i>			
	−0.8	−0.7	−0.6	−0.5
<b>0.0 % DAHP</b>	2.4±0.2	2.2±0.2	2.0±0.1	2.0±0.1
<b>0.25 % DAHP</b>	2.1±0.1	2.0±0.1	2.1±0.1	2.3±0.2
<b>0.5 % DAHP</b>	2.6±0.1	2.6±0.1	2.5±0.2	2.3±0.1
<b>1.0 % DAHP</b>	3±0.2	2.3±0.1	2.1±0.1	2.0±0.1
<b>1.5 % DAHP</b>	2.6±0.1	2.5±0.1	2.3±0.2	2.3±0.1
<b>2.0 % DAHP</b>	2.4±0.1	2.2±0.2	2.1±0.1	2.0±0.1
<b>2.5 % DAHP</b>	3.4±0.2	3.1±0.2	2.6±0.2	2.4±0.1
<b>5.0 % DAHP</b>	2.5±0.2	2.3±0.1	2.0±0.1	1.9±0.1
<b>7.5 % DAHP</b>	2.9±0.2	2.7±0.1	2.2±0.1	1.9±0.1
<b>10.0 % DAHP</b>	3.2±0.2	2.8±0.2	2.3±0.1	2.1±0.1