Electronic Supplementary Material (ESI) for New Journal of Chemistry.


# Electronic Supporting Information

## Polyacrylamide hydrogel derived three-dimensional hierarchical porous N, S co-doped carbon framework for electrochemical capacitors

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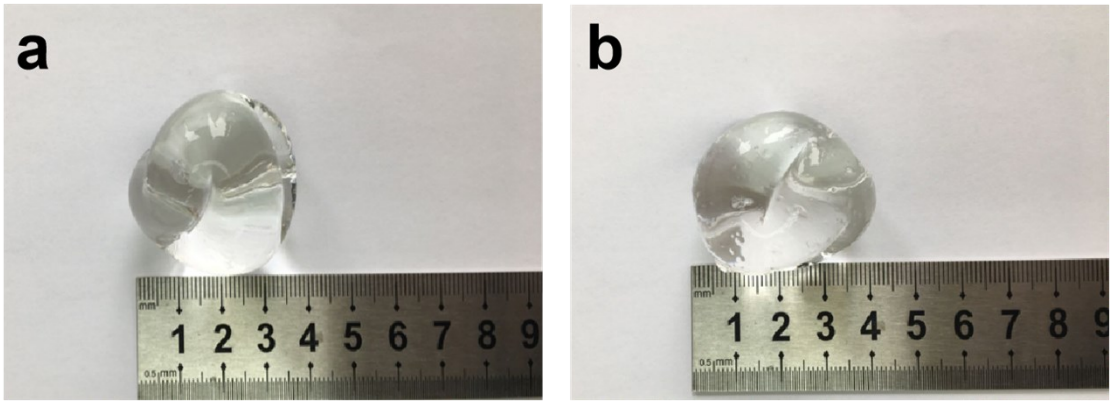


**Fig. S1** Digital images of the PAAG hydrogel (a) without and (b) with the soaked $CH_4N_2S$.

**Table S1** XPS relative contents of C, O, N and S species in the HNC-F and HNSC-F.

| | | | HNC-F | HNSC-F |
|---|---|---|---|---|
| elemental percentages (at. %) | C | | ~88.5 | ~85.5 |
| | | C- Ⅰ | 21.4 | 22.9 |
| | | C- Ⅱ | 13.6 | 53.5 |
| | | C- Ⅲ | 6.6 | 5.62 |
| | | C- Ⅳ | 4.6 | 3.5 |
| | O | | ~6.7 | ~8.4 |
| | | O- Ⅰ | 2.1 | 1.9 |
| | | O- Ⅱ | 2.9 | 3.1 |
| | | O- Ⅲ | 1.7 | 3.4 |
| | N | | ~4.9 | ~5.3 |
| | | N- Ⅰ | 1.1 | 1.7 |
| | | N- Ⅱ | 1.2 | 1.3 |
| | | N- Ⅲ | 2.2 | 2.3 |
| | | N- Ⅳ | 0.4 | 0.5 |
| | S | | ~0 | ~0.8 |
| | | S- Ⅰ | - | 0.2 |
| | | S- Ⅱ | - | 0.2 |

| | | | |
|---|---|---|---|
| | S-Ⅲ | - | 0.2 |
| | S-Ⅳ | - | 0.05 |
| | S-Ⅴ | - | 0.1 |

**Table S2** EIS fitting parameters of the HNC-F and HNSC-F electrodes.

| Parameters | HNC-F | HNSC-F |
|---|---|---|
| $R_s$ | 0.45 | 0.12 |
| $R_{ct}$ | 4.4 | 2.2 |
| C | 0.0044 | 1.20 |
| $Z_1$ | 0.083 | 1.13 |
| $Z_2$ | 0.04 | 0.02 |
| Q | 0.35 | 0.074 |

**Table S3** Comparison in electrochemical properties of the HNSC-F electrode in three-electrode system with other heteroatom-doped carbon electrodes reported in literatures

| **Materials** | **Doped element** | **Electrolyte** | **SC (F $g^{-1}$)** | **VSC (F $cm^{-3}$)** | **Current density (A $g^{-1}$)** | **Ref.** |
|---|---|---|---|---|---|---|
| HNSC-F | N, S | 6 M KOH | 254.4 | 256.9 | 0.5 | This work |
| | | 1 M $H_2SO_4$ | 325.8 | 329.1 | | |
| S-PGHS-900 | S | 0.1 M KOH | 240 | - | 0.5 | 1 |
| MCF | N | 6 M KOH | 247.8 | 171.8 | 0.5 | 2 |
| | | 1 M $H_2SO_4$ | 307.4 | 212.1 | | |
| N/P-TR GO | N, P | 6 M KOH | 165 | - | 0.5 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| BNC-20 | B, N | 6 M KOH | 188 | - | 0.1 | 4 |
| BHAC-850 | B, N | 6 M KOH | 175 | - | 0.5 | 5 |
| MBCP | N, S | 6 M KOH | 221 | - | 0.5 | 6 |
| Asn-5-$NaHCO_3$ | N, S | 1 M $H_2SO_4$ | 220 | - | 0.5 | 7 |
| C-700-1.5 | N | 1 M $H_2SO_4$ | 280 | - | 0.2 | 8 |
| PM-600-1.0 | N | 1 M $H_2SO_4$ | 278 | - | 0.1 | 9 |
| NHG | N | 2 M $H_2SO_4$ | 295 | - | 0.5 | 10 |

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