Supporting Information

Fabrication of 3D Heteroatom-Doped Porous Carbon Derived from Assembly of Chelate Foams via a Solid State Method

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Fig. S1. Photographs of precursors (up) and 3D Chelates Foams(down) for EZ, in 100mL glass beaker.
Fig. S2. Photographs of precursors (up) and 3D Chelates Foams(down) for $DZ_x$, $DZ_{0.5}$, $DZ_1$, $DZ_{1.5}$ are in 100mL glass beakers. $DZ_2$ in 100mL glass beaker. $DZ_{2.5}$ in 200mL glass beaker.
Fig. S3. Photographs of precursors (up) and 3D Chelates Foams (down) for NZx in 25 mL glass beakers.
Figure S4. XRD (A) and IR (B) curves of EZ<sub>x</sub>

Figure S5. XRD (A) and IR (B) curves of DZ<sub>x</sub>
Figure S6. XRD (A) and IR (B) curves of NZ

Figure S7. XRD results, (A) EDTA heated with Zinc sulfate. (B) EDTA heated with Zinc phosphate.
**Figure S8.** XRD result of EZ1 carbonized at different temperature.

**Figure S9.** (A) N\(_2\) adsorption isotherms of EZ\(_1\) carbonized at different temperature and (B) corresponding pore size distribution.
Figure S10. SEM images of (A1 - A3) EZ<sub>1</sub>-C300, (B1 - B3) EZ<sub>1</sub>-C400, (C1 - C3) EZ<sub>1</sub>-C500, (D1 - D3) EZ<sub>1</sub>-C600, (E1 - E3) EZ<sub>1</sub>-C700.
Figure S11. SEM images of EZ₁-C800

Figure S12. SEM images of EZ₁-C900
Figure S13. Nitrogen and Zn content for EZ$_4$-C from XPS result.
Figure S14. Porous structure parameters of NCFs. EZ\textsubscript{1}-C (A1, A2), DZ\textsubscript{1}-C (B1, B2) and NZ\textsubscript{1}-C (C1, C2).
Figure S15. SEM images of EZ$_{0.5}$-C (A1, A2), EZ$_{1.5}$-C (B1, B2) and EZ$_{2}$-C (C1, C2).
Figure S16. SEM images of DZ$_{0.5}$-C (A1, A2) and DZ$_{1}$-C (B1, B2).
Figure S17. SEM images of DZ_{1.5}-C (A1, A2), DZ_{2}-C (B1, B2) and DZ_{2.5}-C (C1, C2).
Figure S18. SEM images of NZ_{0.5}-C (A1, A2), NZ_{1}-C (B1, B2) and NZ_{1.5}-C (C1, C2).
Figure S19. TEM images of EZ$_{0.5}$-C (A1, A2, A3), EZ$_{1}$-C (B1, B2, B3) and EZ$_{1.5}$-C (C1, C2, C3).
Figure S20. TEM images of DZ$_{0.5}$-C (A1, A2, A3), DZ$_1$-C (B1, B2, B3), DZ$_{1.5}$-C (C1, C2, C3) and DZ$_2$-C (D1, D2, D3).
Figure S21. TEM images of NZ$_{0.5}$-C (A1, A2, A3) and NZ$_1$-C (B1, B2, B3).
Figure S22. Nitrogen content of NCFs.

Figure S23. Raman curves of EZ$_X$-C.

Figure S24. Raman curves of DZ$_X$-C.
Figure S25. Raman curves of NZ$_X$-C
Figure S26. N 1s XPS spectrum of EZ_{X}-C, A) EZ_{0.5}-C, B) EZ_{1}-C, C) EZ_{1.5}-C and D) EZ_{2}-C.
Figure S27. N 1s XPS spectrum of DZ$_{x}$-C, A) DZ$_{0.5}$-C, B) DZ$_{1}$-C, C) DZ$_{1.5}$-C, D) DZ$_{2}$-C and E) DZ$_{2.5}$-C.
Figure S28. N 1s XPS spectrum of NZₓ-C, A) NZ₀.₅-C, B) NZ₁-C and C) NZ₁.₅-C.
Figure S29. CV and LSV curves of EZ$_X$-C, A1, A2 (EZ$_{0.5}$-C), B1, B2 (EZ$_1$-C), C1, C2 (EZ$_{1.5}$-C) and D1, D2 (EZ$_2$-C).
Figure S30. CV and LSV curves of DZ$_{x}$-C, A1, A2 (DZ$_{0.5}$-C), B1, B2 (DZ$_{1}$-C), C1, C2 (DZ$_{1.5}$-C) and D1, D2 (DZ$_{2}$-C).
Figure S31. CV and LSV curves of \( \text{DZ}_{2.5} \)-C.
Figure S32. CV and LSV curves of NZ$_X$-C, A1, A2 (NZ$_{0.5}$-C), B1, B2 (NZ$_1$-C) and C1, C2 (DZ$_{1.5}$-C).
Figure S33. Koutecky-Levich plots at different potentials of A) NZ$_{1.5}$-C, B) EZ$_{2}$-C, C) DZ$_{2.5}$-C.

Figure S34. Electron transfer numbers calculated from K-L plots.