Preparation of MOF-based Nitrogen Self-Doped Porous Carbon and Its Electrochemical Properties

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Metal-organic frameworks (MOFs) are widely used as precursors to prepare porous carbon materials due to their highly ordered porous structure and large specific surface area. In this paper, a metal-organic framework $\{[\text{Zn}(\text{1,4-BDC})_{0.5}(\text{3-NH}_2\text{-trz})]\cdot(\text{solvent})\}_n$ was prepared using a solvent method as a precursor to prepare nitrogen self-doped porous carbon ZAPC-T by a direct carbonization, and the effect of different carbonization temperatures on the microstructures, compositions, and electrochemical properties of the nitrogen self-doped porous carbon ZAPC-T samples was investigated. Results showed that the specific surface area of ZAPC-800 reached $728.57 \text{ m}^2 \text{ g}^{-1}$ with nitrogen and oxygen contents of 19.09% and 5.93%, respectively. When the carbonization temperature was 800°C , the specific capacitance of ZAPC-800 was 225.4 F g^{-1} at a current density of 1.0 A g^{-1} , and after 5000 cycles, the capacitance retention was as high as 83.01% with constant current charging and discharging. The specific capacitance decay rate was only 21.2% when the current density was increased from 1.0 A g^{-1} to 10.0 A g^{-1} . Thus, nitrogen self-doped porous carbon ZAPC-800 showed excellent electrochemical properties and good cycling stability. This study provides useful experimental data for the preparation of MOF-based nitrogen self-doped porous carbons and their applications.

Keywords: supercapacitor; metal-organic frameworks; hydrothermal method; nitrogen self-doped porous carbon; electrochemical

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