Porous Nitrogen-Doped Carbon Derived from Peanut Shell as Anode Material for Lithium Ion Battery

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The development of anode materials originating from renewable resources with high performance and low cost has become an important research direction in the development of lithium ion batteries (LIBs). Herein, peanut shell, a common biomass, was used as a raw material to synthesize nitrogen-doped carbon applied in the anode of LIBs. The effects of calcination temperature and acid treatment on the electrochemical performance of the peanut shell-derived carbon material were first studied; it was found that a higher calcination temperature will improve the performance of the carbon material. The carbon prepared at 700°C presented a capacity at 180 mA h g\(^{-1}\) (0.1 C), much higher than for samples prepared at 300 and 500°C. The acid treatment can further improve the capacity to 320 mA h g\(^{-1}\). On this basis, nitrogen doping was introduced into the carbon material with melamine as the nitrogen source. It was found that the doping method will affect the final properties of the carbon; the nitrogen-doped carbon prepared by a one-pot method (doping and carbonization simultaneously) exhibited a capacity at 570 mA h g\(^{-1}\) with quite stable cycling performance, larger than that prepared by a successive method (carbonization followed by doping). This work demonstrates a promising pathway for the utilization of biomass to prepare active anode material for LIBs.

Keywords: Peanut shell; Carbon; Anode material; Lithium ion battery; Nitrogen doping