Maximizing specific capacity of nutty hard carbon: Impact of treatment conditions on structural and electrochemical properties

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Hard carbon (HC) has attracrted tremendous attention in sodium ion batteries (SIBs) as promising negative electrode material due to its low cost, environmental friendliness and stable cyling performance. However, due to the limited capacity and low initial columbic efficiency (ICE), the actual full cell application of HC faces significant obstacles. Therefore, preparation process was optimized to investigate the impact of the pre-treatment conditions and degree of graphitization on electrochemical performance and to resolve abovementioned problems. By increasing the carbonization temperature, a high degree of graphitization was attained along with increased reversible capacity and decreased ICE. Additionally, a substantial correlation was shown between the pre-oxidation with structural characteristics and electrochemical performance. A higher specific capacity was achieved by obtaining HC with large domain sizes, low surface areas, and porosities, as shown by structural characterization. The walnut shell derived HC with pre-oxidation of 300℃ and carbonization temperature of 1400℃ delivered a high reversible capacity of 360 mAh/g with good capacity retention in a Na cell. Moreover, this research illustrated that the pre-oxidation increased the amount of C=O bond which improved the adsorption capacity of sodium ions and further increased the specific capacity.

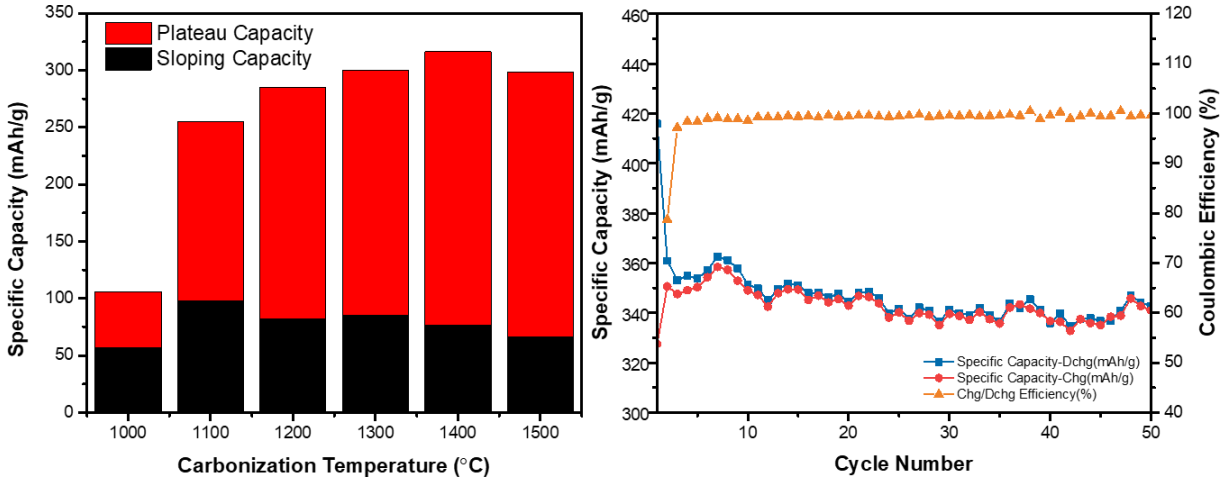

Figure1: The electrochemical performances of obtained hard carbon.

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