P-doped coffee ground-derived hard carbon for boosting sodium-ion batteries

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The paper proposed the facile and successful preparation of P-doped coffee ground-derived hard carbon using H_3PO_4 as a dopant material for sodium-ion batteries. The manipulation with 1-3 M of H_3PO_4, contributed to finding the optimal concentration for the maximum incorporation of phosphorus ions into the carbon framework. The use of 2 M of H_3PO_4 dopant material for hard carbon as anode for sodium-ion battery delivers promising electrochemical performance. P-doped coffee ground-derived hard carbon carbonized at 1300 °C exhibits a high reversible capacity of 341 mAh g^{-1} at 20 mA g^{-1} (83 % retention upon 100 cycles). This excellent electrochemical performance of P-doped hard carbon can be attributed to microporous structure, large interlayer spacing, and the formation of C-P bonds.

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