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Synthesis of $FePO_4.2H_2O$ nanocomposites for fabrication of lithium ion battery using impinging stream reactor

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An impinging stream reactor has been adopted for synthesis of nanoscale $FePO_4.2H_2O$ particles. The experiments indicate that the application of the impinging streams is able to significantly enhance the mass transfer rate of the reactant solutions through strong turbulent eddy interactions due to the impingement of two narrow reactant streams at high velocities. The $FePO_4.2H_2O$ nanocomposites were synthesised under the conditions that pH value (pH=1.2, 1.4, 1.6, 1.8 and 2.0), reagent concentration (C=0.5, 1.0 and 1.5 mol L^{-1}), and volumetric flow rate (V=17.15, 34.30, 51.44, 68.59 and 85.74 mL min^{-1}) were precisely controlled. Effects of the pH value, reagent concentration, and volumetric flow rate on synthesis of $FePO_4.2H_2O$ nucleus have been studied when the impinging stream reactor is to operate at nonsubmerged mode. The as-synthesised $FePO_4.2H_2O$ and corresponding $LiFePO_4$/C prodcuts were characterised by applying XRD, SEM and charge-discharge test. It has been demonstrated that under the optimised opertation condition (pH=1.6, C=1 mol L^{-1}, V=85.74 mL min^{-1}), the $LiFePO_4$/C possesses the best charge-discharge performance while the discharge capacities is able to reach 152.6, 146.9, 139.1, 130.4 and 118.2 mAh g^{-1} at 0.1 C, 0.5 C, 1 C 2 C and 5 C current rates, respectively. It was revealed that the $LiFePO_4$/C synthesised at pH=2.0, C=1 mol L^{-1}, V=85.74 mL min^{-1} has the most stable cycling performance with the discharge capacities reaching 140.6 and 141.8 mAh g^{-1} at a rate of 0.5 C at the first and the 100th cycles, respectively.

Biography

Bin Dong is currently a PhD student at International Doctoral Innovation Centre, University of Nottingham Ningbo China. His research expertise is on materials fabrication, characterisation and electrochemistry.

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