Generation of a mesoporous web-like carbon-vanadium oxynitride as an electrode material for symmetric supercapacitors

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ABSTRACT

Unique mesoporous web-like carbon-vanadium oxynitride (C-V_2NO) have been synthesized at different nitridation temperatures of 700 °C, 800 °C and 900 °C using the ammonium metavanadate (NH_4VO_3) and melamine ($C_3H_6N_6$) as precursors by a facile hydrothermal method. The N_2 physisorption data of the C-V_2NO materials displayed a high specific surface area (SSA) (from 91.6 to 121.6 $m^2\ g^{-1}$) with a pore diameter ranging from ~ 2 to 8 nm. The electrochemical performance of C-V_2NO at different temperatures was carried out using a 6 M KOH aqueous electrolyte, with the C-V_2NO synthesized at 800 °C revealing the highest electrochemical performance compared to other temperatures in a three electrode configuration. A symmetric capacitor was assembled using the C-V_2NO@800 °C as both positive and negative electrodes and evaluated in a wide potential window range of 0.0 - 1.8 V. The C-V_2NO//C-V_2NO displayed a specific capacity of 58 mA h g^{-1} with a specific energy of 38 Wh kg^{-1} and a corresponding specific power of 735 W kg^{-1} at a specific current of 1 A g^{-1}. These results make this simply synthesized material to be a potential candidate for supercapacitor application.