2nd World Congress and Expo on
Nanotechnology and Material Science
April 04-06, 2016 at Dubai, UAE

SiO_2/3D porous carbon composite as a superior anode material for lithium ion butteries

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Silica (SiO_2) has been considered as one of the most promising materials for anode of lithium ion batteries (LIBs) owing to its low discharge potentials and high theoretical specific capacity. Furthermore, SiO_2 is a resource abundant, low cost and environmental friendly material. However, the practical use of SiO_2 nanostructure is hindered by its intrinsic poor electric conductivity and large volume changes during repeated charge-discharge processes. To overcome these drawbacks, we fabricated a SiO_2/3D porous carbon nanocomposite by a facile and environmentally friendly synthesis route. The structural and electrochemical characteristics of the composite anode material have been investigated by X-ray diffraction (XRD), scanning electron microscope (SEM), transmission electron microscope (TEM), and electrochemical measurements. It is found that carbon matrix with three dimensional porous structure is favorable for the short transport of both electrons and Li ions, leading to good conductivity and fast charge/discharge rates. Moreover, the porous structure of the matrix could efficiently alleviate the volume expansion of SiO_2 during Li intercalation. As a result, the SiO_2/porous carbon nanocomposite demonstrated a high reversible capacity of 498.8 $mAhg^{-1}$, good cycling performance (a specific capacity of 434 $mAhg^{-1}$ after the 50th cycle at a current density of 100 mAg^{-1}) and high rate capability (187.4 $mAhg^{-1}$ even at 5 Ag^{-1}).