Xanthan Gum as a Carbon Source for Preparation of Carbon-Silicon/Graphite Composite as Anode Materials for Lithium Ion Batteries

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Silicon anode materials have advantage of very high theoretical specific capacity (4200 mA h g^{-1}), and low intercalation lithium potential, but disadvantage of huge volume expansion. In this paper, xanthan gum (XG) and glucose (GLU) as carbon sources, and niobium pentoxide and a dispersant are added to modify the nano-silicon to prepare a series of carbon-silicon composite. The carbon-silicon composite are ground with graphite to obtain the carbon-silicon/graphite composite anode material Si@XG-G. XRD tests show that these composite materials have strong characteristic diffraction peaks of graphite and silicon, and there are no peaks of amorphous carbon. The first discharge and charge specific capacity of Si@XG-G is 414 mA h g^{-1} and 259 mA h g^{-1} , respectively, with a coulombic efficiency of 62.5 %. The first discharge and charge specific capacity of Si@XG/NO-G modified by adding niobium pentoxide (NO) was 448 mA h g^{-1} , and 285 mA h g^{-1} , with a coulombic efficiency of 63.6 %. When mixing the carbon-silicon composite that is doped by niobium pentoxide with graphite to prepare the carbon-silicon/graphite composite anode material, the first charge and discharge specific capacity as well as the coulombic efficiency of the composite anode materials are significantly improved. In addition, when modified by polyvinylpyrrolidone (PVP) again, the first discharge specific capacity and charge specific capacity of Si@XG/NO/PVP-G is 671 mA h g^{-1} and 489 mA h g^{-1} , respectively, with a coulombic efficiency of 72.9%. Obviously, the active material Si@XG/NO/PVP-G has a further improved specific capacity and coulombic efficiency.

Keywords: Carbon-silicon composite, Silicon/graphite composite, Xanthan gum, Niobium pentoxide,

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