Accepted Manuscript

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PII: S0925-8388(18)32437-X

DOI: 10.1016/j.jallcom.2018.06.316

Reference: JALCOM 46652

To appear in: *Journal of Alloys and Compounds*

Received Date: 15 March 2018

Revised Date: 23 June 2018

Accepted Date: 25 June 2018

Please cite this article as: Z. Li, L. Li, W. Zhong, A. Cheng, W. Fu, Z. Li, H. Zhang, Simple and efficient fabrication of pomegranate-like Fe_2O_3@C on carbon cloth as an anode for lithium-ion batteries, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.06.316.

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Simple and efficient fabrication of pomegranate-like Fe_2O_3@C on carbon cloth as an anode for lithium-ion batteries

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Abstract

Pomegranate-like Fe_2O_3@C nanoparticles on carbon cloth as an anode for lithium-ion batteries are synthesized via a combination of dip-coating and hydrothermal synthesis. The spontaneous crosslinking reaction between sodium alginate (SA) and Fe^{3+} first creates a chelate compound, and then the SA-Fe^{3+} chelate is converted to Fe_2O_3@C nanoparticles after a simple hydrothermal treatment. The Fe_2O_3@C nanoparticles exhibit pomegranate-like morphology with an average diameter of 118 nm and are composed of smaller Fe_2O_3@C secondary nanoparticles of 13.7 nm. Such a hierarchical nanostructure can increase the accessible surface area of the Fe_2O_3@C/CC electrode, leading to enhanced electrochemical efficiency for the Li^+ insertion/deinsertion reaction. Furthermore, by carefully controlling dip-coating time, the Fe_2O_3@C nanoparticles are individually and uniformly distributed on the CC surface, which supplies expansion space for Li^+ insertion and protects the electrode from structural cracks. Owing to these structural characteristics, the

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