A facile and green process to synthesize few layer graphene/$LiFePO_4$ composite cathodes for Lithium-ion batteries

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This research focuses on the utilization of few layer graphene as conductive additives in $LiFePO_4$ for Li ion batteries. Mass production of single layer carbon or graphene is being hindered by the expensive cost and environmental threat of its conventional synthesis. A green, facile, low-cost and scalable industrial method using jet cavitation is utilized to prepare few layer graphene (FLG) through natural graphite delamination in NMP. Through this method, high quality graphene was swiftly produced without the incorporation of any strong acids and oxidants. Graphene flakes which were subsequently characterized using Raman spectroscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM) proved the graphene flakes yielded and Atomic force microscopy (AFM) revealed that up to 85% of the prepared FLG were less than 5 nm thick and most of FLG are belong to 10 layers. The obtained graphene was applied as conductive additives to improve rate capability of $LiFePO_4$ cathode. Different tests were carried out such as charge/discharge tests, rate capability, AC impedances and cyclic voltammetry tests to investigate its electrochemical properties. At 0.1C, a stable specific capacity of approximately 149 mAh g^{-1}, which is superior to that of $LiFePO_4$/KS6 cathode. At 10 C, more than 65 mAh g^{-1} can be approached at optimized condition. These results indicate that this method not only paves the way for cheaper and safer production of graphene but also holds great potential applications in energy-related technology.

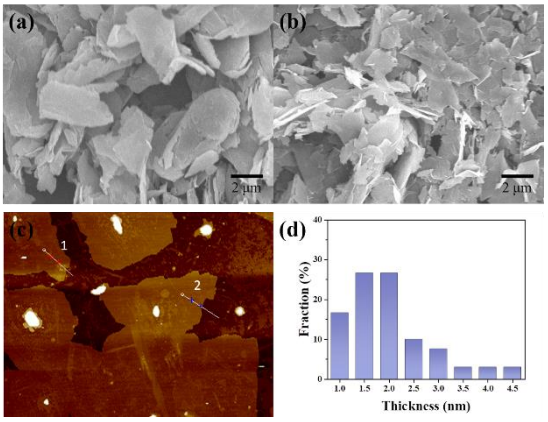

Figure 1. SEM images of (a) Nature graphite; (b) FLG; (c) AFM image of FLG; (d) Thickness distribution of FLG measured by AFM.

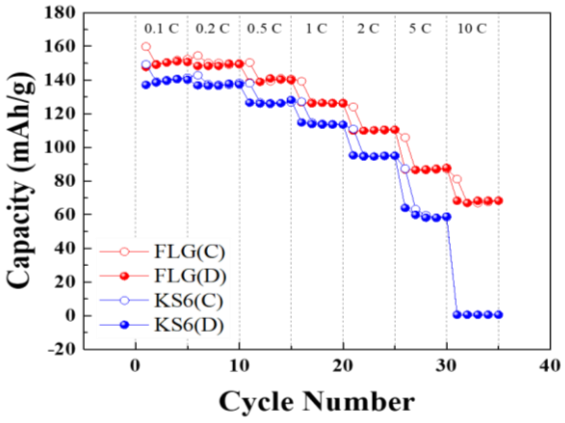

Figure 2. Rate capability tests of $LiFePO_4$/FLG and $LiFePO_4$/KS6 composite cathodes.