PEDOT conformal coating on prepared electrode for high performance Lithium-ion battery via Vapor Reaction Printing

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Since the Sony Corporation commercially introduced a lithium ion battery (LIB), LIBs have been widely used in portable electronic devices such as mobile phones and laptops. Furthermore, there are increasing demands for improving power and energy density of LIB to meet the requirements of applications in electric vehicles and energy storage systems. $LiFePO_4$ (LFP) is a representative active material for large-sized LIBs because it has high theoretical energy density of 170 mA h g^{-1}, high safety and low cost. However, LFP suffers from its two intrinsic problems; low electric and ionic conductivity [1]. Surface modification, especially surface coating, is one of the effective methods overcome the problems of LFP. Many studies have been reported on advantages of surface coating on single particle level. Nevertheless, the decrease in the volumetric capacity and the complex manufacturing conditions can be problematic for a particle-scale coating.

Here, we report a facile synthesis of conformal thin-layered conducting poly(3,4-ethylenedioxythiophene) (PEDOT) via vapor reacting printing (VRP) on prepared electrodes. The PEDOT coated LFP electrodes exhibited remarkable improvements both in cycling stability (96.6% of the initial capacity after 100 cycles) and in their rate capability (0.668 mA h at a rate of 1C). The uncoated pristine LFP electrode showed only 23.5% of the initial capacity after 100 cycles and 0.181 mA h at a rate of 1C. These outstanding results were attributed to the PEDOT layer, which offers improved conduction pathways and ion diffusion. This new approach of coating on prepared electrodes with a conductive conformal thin layer is promising for high-performance lithium-ion batteries.

References:

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