Electrospun 3D structured carbon current collector for Li/S batteries

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Light weight carbon nanofibers (CNF) fabricated by a simple electrospinning method and used as a 3D structured current collector for a sulfur cathode. Along with a light weight, this 3D current collector allowed us to accommodate a higher amount of sulfur composite, which led to a remarkable increase of the electrode capacity from 200 to 500 mAh g^{-1} of the electrode including the mass of the current collector. Varying the electrospinning solution concentration enabled obtaining carbonized nanofibers of uniform structure and controllable diameter from several hundred nanometers to several micrometers. The electrochemical performance of the cathode deposited on carbonized PAN nanofibers at 800 ◦C was investigated. An initial specific capacity of 1620 mAh g^{-1} was achieved with a carbonized PAN nanofiber (cPAN) current collector. It exhibited stable cycling over 100 cycles maintaining a reversible capacity of 1104 mAh g^{-1} at the 100th cycle, while the same composite on the Al foil delivered only 872 mAh g^{-1}. At the same time, 3D structured CNFs with a highly developed surface have a very low areal density of 0.85 mg cm^{-2} (thickness of ~25 μm), which is lower for almost ten times than the commercial Al current collector with the same thickness (7.33 mg cm^{-2}).

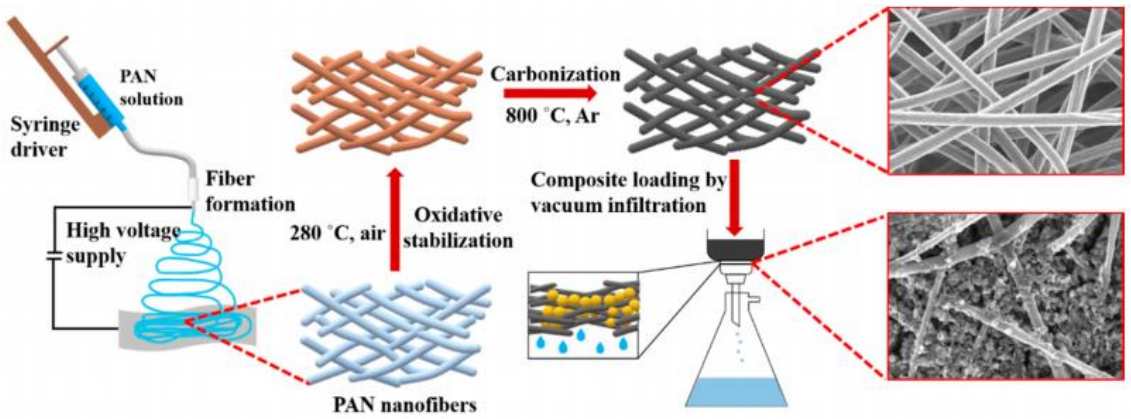

Figure 1. Scheme of carbon nanofiber fabrication and sulfur-based cathode preparation.

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