ACS central science

Exploiting Anti-T-shaped Graphene Architecture to Form Low Tortuosity, Sieve-like Interfaces for High-Performance Anodes for Li-Based Cells

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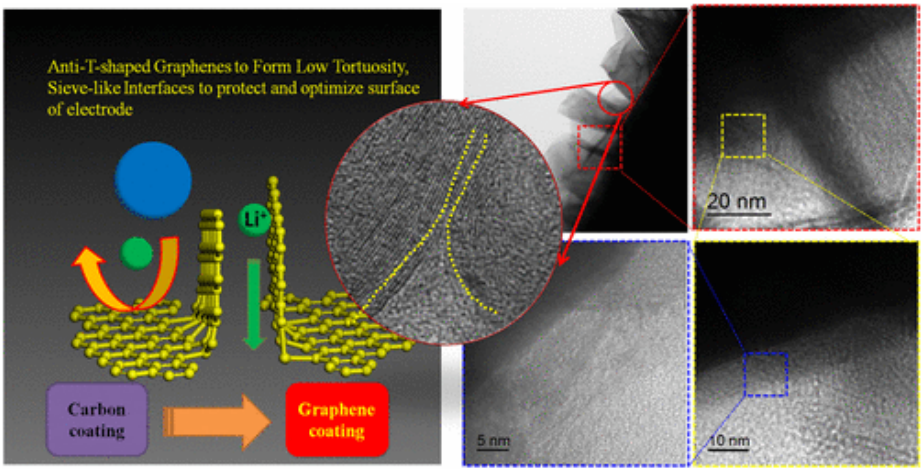
ACS Cent. Sci., Article ASAP

DOI: 10.1021/acscentsci.7b00444

Publication Date (Web): December 13, 2017



Graphitic carbon anodes have long been used in Li ion batteries due to their combination of attractive properties, such as low cost, high gravimetric energy density, and good rate capability. However, one significant challenge is controlling, and optimizing, the nature and formation of the solid electrolyte interphase (SEI). Here it is demonstrated that carbon coating via chemical vapor deposition (CVD) facilitates high electrochemical performance of carbon anodes. We examine and characterize the substrate/vertical graphene interface (multilayer graphene nanowalls coated onto carbon paper via plasma enhanced CVD), revealing that these low-tortuosity and high-selection graphene nanowalls act as fast Li ion transport channels. Moreover, we determine that the hitherto neglected parallel layer acts as a protective surface at the interface, enhancing the anode performance. In summary, these findings not only clarify the synergistic role of the parallel functional interface when combined with vertical graphene nanowalls but also have facilitated the development of design principles for future high rate, high performance batteries.