Performance Enhancement of Lithium Ion Battery with Vertically and Horizontally Aligned Graphene Anode

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Improving the specific capacity of conventional graphite anodes of Li-ion battery remains the key challenge for large-scale applications. It has been demonstrated using magnetically aligned graphite flakes as anode increases the lithium storage capacity by a factor of between 1.6 and 3 [1]. Graphene nanoflakes with high crystallinity, small lateral size, and high electron mobility, have displayed promising performance as anode material [2]. In addition, orientation control and alignment of graphene flake have been achieved with a weak magnetic field [3]. In this work, we aligned graphene flakes vertically and horizontally using small commercial magnets. The electrochemical performance of aligned graphene was investigated in a full battery with magnetically aligned graphene as anode and $LiFePO_4$ as cathode. Both vertically and horizontally aligned graphene batteries showed electrochemical performance enhancement while vertically aligned elelctrode displayed much higher improvement than that of horizontally aligned battery.

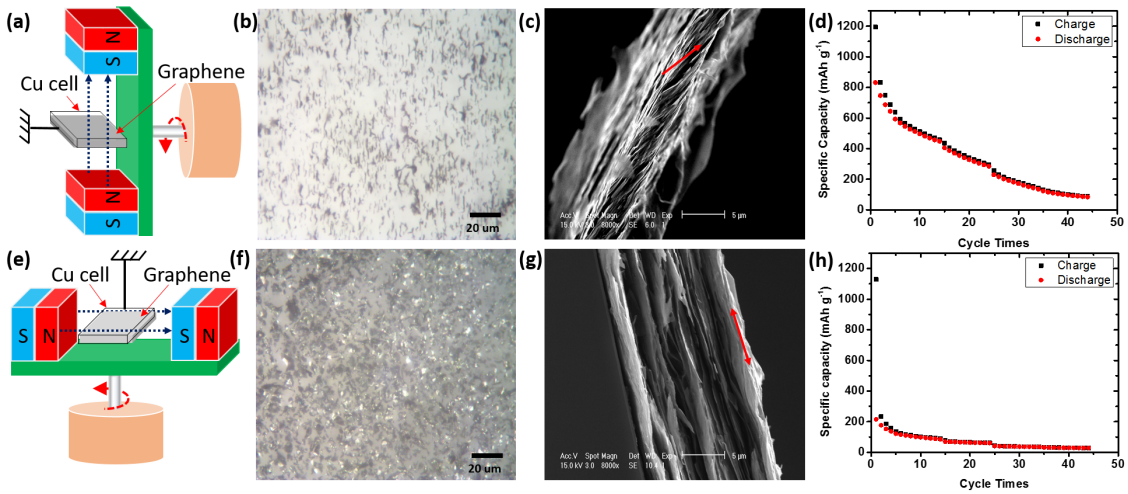

Figure 1. Vertical and horizontal alignment of graphene with rotating magnetic field. (a) and (e) Schematic of vertical/horizontal alignment of graphene dispersion in cooper cell with vertical/horizontal rotating magnetic field. (b) and (f) Top view optical microscopic image of vertically/horizontally aligned graphene dispersion. (c) and (g) SEM image of vertically/horizontally aligned graphene anode. (d) and (h) Specific capacity of vertical/horizontal aligned graphene batteries.

References:

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