The Effect of Fluorination of Graphene on the Effectiveness of Primary Batteries (Li/CFx) and Supercapacitors

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The following research was conducted to study the effect of Fluorination of Graphene on the effectiveness of primary batteries and supercapacitors. Fluorination is the process by which Fluorine is incorporated into the Graphene structure, it is hypothesized to cause a boost in the capacity of both devices. Fluorination was done via exposing the Graphene to Fluorine plasma generated through a capacitively coupled rf plasma for 4 different intervals of time: 0, 5, 15, and 30 hours. For batteries, the CFx (Fluorinated Graphene) was attached to copper and Aluminum foils and then placed within a coin cell; for the supercapacitors, CFx was attached to two stainless steel meshes and placed within a swagelok cell. For the batteries, with higher levels of Fluorination, the capacitance increased immensely from a baseline capacitance of 72 mAh/g to 850 mAh/g with the highest Fluorination of 30 hours. For supercapacitors, low level of Fluorination showed a boost in the capacitance from 107 F/g to 116 F/g, but high amounts of Fluorine caused a drop in capacitance to 37 F/g in the highest Fluorination. This data suggests heavy Fluorination proves beneficial when used in batteries and was able to greatly improve the efficiency of the batteries through an enormous boost in capacitance. Supercapacitors, on the other hand, high levels of Fluorination proved to be detrimental but low levels of Fluorination, as shown in the 5-hour sample, actually improved the capacitance of the supercapacitors from the baseline.

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