

Electrophoretic coating of LiFePO₄/Graphene oxide on Carbon Fibers as High-Performance Cathode Electrodes for Structural Batteries in Aeronautics

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Structural battery composites, typically based on Carbon Fibers (CF), are a class of structural power composites which can be included in the framework of airplanes and cars to reduce weight and provide energy for distributed electronics at the same time.[1] CF can be easily used as anode in Li ion batteries, but need chemical functionalization to be used as cathode. Here, we describe a binder-free method to deposit a composite of lithium iron phosphate (LiFePO₄) and electrochemically exfoliated graphene oxide (EGO) on CF. To this aim, we use Electrophoretic Deposition (EPD) which is a versatile, scalable and cost-effective technique to deposit uniform coatings on electrodes for Lithium Ion Batteries.[2] We performed comparative tests varying the surface tension and chemistry of the solvent using pulsed bias to achieve uniform LiFePO₄/EGO coatings (**Figure 1a**). The optimal conditions allowed to achieve a high LiFePO₄ mass ratio >90 wt%, also featuring good adhesion on the CF and low cracking or degradation upon battery cycling.

Samples were characterized by XRD, Raman and SEM measurements. The electrochemical performance of the coated CF was investigated through cyclic voltammetry and galvanostatic charge/discharge showing excellent rate performance (**Figure 1b**) at different current densities, as tested in Half-Cell vs. Li, outperforming similar state-of-the-art cathode materials. Besides the promising performance of the LiFePO₄/EGO we describe here, the EPD method shall be used for deposition on CF of composite materials made of carbon and metal oxides,[3] paving the way towards facile electrophoresis synthesis of cathode materials for all Li batteries.

REFERENCES

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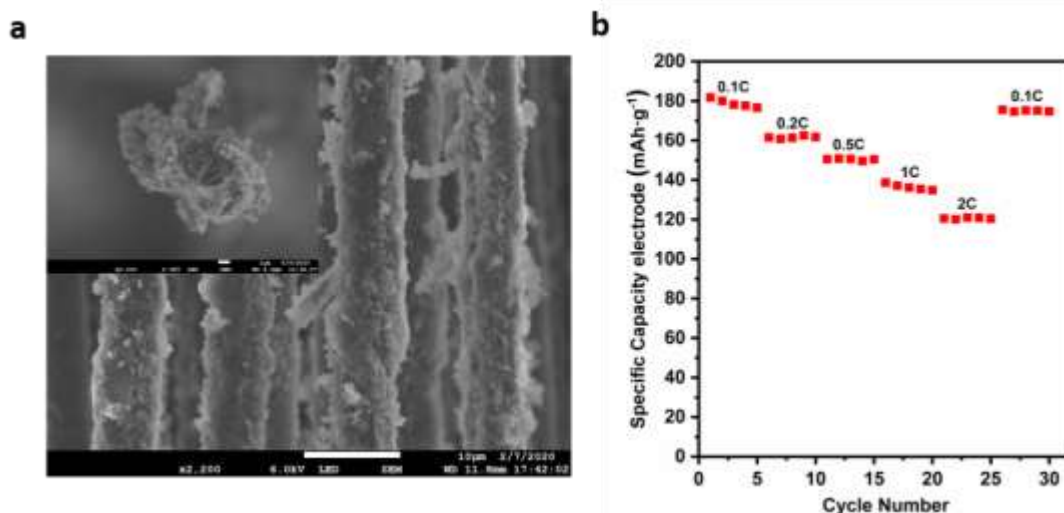


Figure 1. (a) SEM LiFePO₄/EGO Coated CF. Inset: cross-section view (b) Specific capacities (normalized over the total electrode mass) of the LiFePO₄/EGO optimum sample at various C-rates.