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Electrophoretic deposition of graphene-related materials for positive electrodes in structural batteries

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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 vehicles to reduce weight and provide energy for distributed electronics simultaneously (Figure 1a).[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 ($LiFePO_4$) 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 (Figure 1b).[2] Various parameters such as deposition time and potential were evaluated to achieve uniform $LiFePO_4$/EGO coatings. The electrode composite yields specific energy density of 222.14 $Wh.kg^{-1}$ and power density of 0.29 $kW.kg^{-1}$ with 88.1% capacity retention at 1 C over 300 cycles in a full battery cell. Besides the promising performance of the $LiFePO_4$/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 positive electrode materials.

References

[1] L.E. Asp, M. Johansson, G. Lindbergh, J. Xu, D. Zenkert, Funct. Compos. Struct. 1 (2019) 042001

[2] J. Hagberg, H.A. Maples, K.S.P. Alvim, J. Xu, W. Johannisson, A. Bismarck, D. Zenkert, G. Lindbergh, Compos. Sci. Technol. 162 (2018) 235–243.

[3] Z.Y. Xia, M. Christian, C. Arbizzani, V. Morandi, M. Gazzano, V. Quintano, A. Kovtun, V. Palermo, Nanoscale. 11 (2019) 5265–5273.

Figures

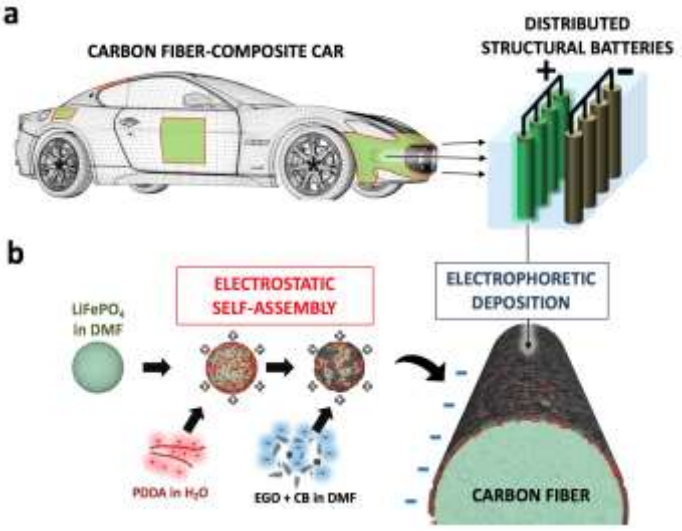

Figure 1: a) Structural Battery Concept b) Schematic illustration of EPD synthesis of the $LiFePO_4$/EGO electrode composite.