A High-Capacity and Long-Cycle-Life Lithium-Ion Battery Anode Materials; Graphene Encapsulated Co_3O_4 Nanoparticles

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For practical large-scale production for catalyst synthesis, the preparation process must be simple, scalable, and cost effective. To this end, many methods have been proposed. Nonetheless, these methods suffer from intrinsic drawbacks, such as (i) the requirement of complicated multistep processes that include mixing, precipitation, cleaning, drying, calcining, and so on; (ii) catalyst poisoning by chemical residues; (iii) severe conditions required for alloying; (iv) poor control over the mean size and size distribution of catalyst particles; and (v) poor adhesion with supporting materials. [1]
More specifically, long-term catalytic efficiency can be greatly improved by addressing the typical degradation mechanisms of catalysts, such as agglomeration, dissolution into the electrolyte, poisoning of catalytic sites and degradation of the catalytic support. [2]
Here, we introduce a facile synthetic process for inorganic-organic hybrid catalyst systems, specifically those of graphene encapsulated cobalt oxide for Li-ion battery anode materials.

References

[1] Dong Sung Choi et al., Advanced Materials, 33 (2016) 7115-7122
[2] Heeyeon Kim et al., ACS Nano, 6 (2015) 5947-5957

Figures

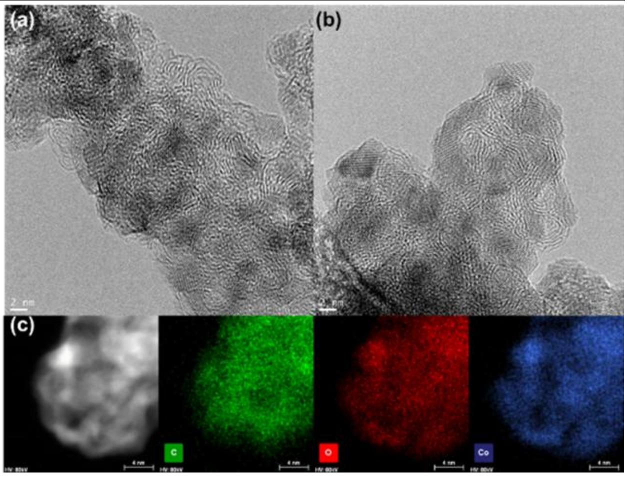

Figure 1: High resolution TEM images of graphene encapsulated Co_3O_4 nanoparticles and HAADF image and EDS maps of C, O and Co.

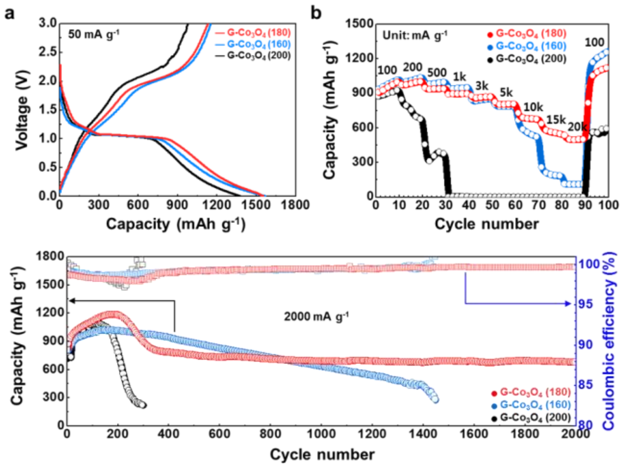

Figure 2: (a) Galvanostatic first cycle discharge /charge voltage profiles and (b) rate capability of the graphene encapsulated Co_3O_4 nanoparticles. (c) Long-term cycling stability of graphene encapsulated Co_3O_4 nanoparticles.