Materials Poster Abstract

Graphene-based cathodes for next generation lithium-sulfur batteries

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Beyond today's incumbent technology, and among the many next-generation battery options, lithium-sulfur batteries are leading the way due to initially simpler manufacturing, lower costs, and the promise of outstanding performance that can enable a step-change for increasingly demanding energy storage requirements in transportation and aerospace. At present several challenges stand in the way of Li-S technology achieving its potential including expansion-induced cracking in the cathode and capacity degradation due to dissolution of polysulfide intermediaries in the electrolyte. Several approaches have been proposed to tackle these challenges with the use of nanomaterials and novel nanoarchitectures receiving much attention.

Graphene-based materials offer several advantages as nanocarbons in Li-S cathodes by improving the electronic conductivity of sulfur, introducing tolerance to volume expansion and inhibiting the shuttle effect of soluble polysulfides. In this presentation, we present the development of cathodes for Li-S batteries based on graphene oxide (GO) and reduced graphene oxide (RGO) exploiting the material's 2D morphology and excellent binding affinity between graphene oxide's functional groups and sulfur. We show enhanced coulombic efficiencies and cell stabilities over 100 cycles while achieving specific capacities greater than 1000 mAh/gS. These results are benchmarked throughout against control cathodes composed of Ketjen Black.