Nitrogen-doped pierced graphene spheres as Li-air battery electrode

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Global warming, oil dependency and environment pollution need to shift from an oil-based economy to an electricity-based civilization urgently. So far, among various electrochemical energy storage devices, the lithium-air battery is considered to be one of the most promising energy storage systems, with a theoretical energy density nearly 10 times that of commercial lithium-ion batteries in principle, which has triggered worldwide interest. However, the performance of lithium-air batteries is limited by several issues regarding both the electrodes and electrolytes to low cycle life and rate capability. The oxygen reduction process leads to the formation of lithium peroxide (Li$_2$O$_2$) on the carbonaceous electrode, which blocks the oxygen pathway and limits the capacity of the lithium-air batteries. Accordingly, the choice of an optimum air electrode is one of the challenges in lithium–air research and development.

In this work, we designed and prepared a 3-D structure with nitrogen-doped (N-doped) pierced graphene spheres as a lithium-air battery electrode by a spray-drying approach. The pierced N-doped graphene spheres contain hierarchically porous from nano-porosity to micrometer-sized porosity, which are conducive to rapid oxygen diffusion. Furthermore, nano-pores on the graphene sheets not only provide an appropriate site for Li-O$_2$ reactions, but also prevent excessive growth of the discharge products that block chemical pathways. The resultant of N-doping porous graphene spheres was demonstrated to act as a metal-free electrode with a much better electrocatalytic activity for Li-O$_2$ reactions.

Detailed synthetic procedure and electrochemical properties of hierarchically porous nitrogen-doped graphene spheres as lithium-air battery electrode will be presented at the meeting.

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