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High Areal Capacity, Long Cycle Life Li-O₂ Cathode Based on Highly Elastic Gel Granules

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Abstract

We introduce a “gelating-cutting” strategy to improve specific areal capacity and cycle life for Li-O₂ cathode. Conventional Li-O₂ cathode with liquid electrolyte is gelated with highly elastic crosslinked polymer and cut into 50~200 μm granules. The gaps between the packed gel granules efficiently induce oxygen to the inner part of the cathode, leading to even Li₂O₂ growth in thick cathode. Meanwhile, the elasticity of the polymer chain helps to keep good contact between carbon and Li₂O₂ nanoparticles, which facilitates the electron transfer and improves the cyclability. Without any catalyst, the granular gel cathode is able to run 170 cycles at a fixed capacity of 1000 mAh g_{carbon}⁻¹, or maintains a specific capacity higher than 10500 mAh g_{carbon}⁻¹ (12.6 mAh cm⁻²) during 11 cycles of full discharge-charge. Since good contact is the precondition to any electrochemical reaction, our strategy is a general way to enhance the performance of Li-O₂ cathodes.

Keywords: Li-O₂ battery; areal capacity; elastic polymer; Li₂O₂ growth; gel

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