Mechanical Abuse Simulation and Effect of Graphene Oxides on Thermal Runaway of Lithium ion Batteries

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The challenge of suppressing thermal runaway in lithium ion batteries (LIBs) under thermal and mechanical abuses is critical in practice applications. The graphene oxides (GOs) modified $\text{LiNi}_{0.5}\text{Mn}_{0.3}\text{Co}_{0.2}\text{O}_2$ (NMC532) active materials were prepared on aluminum foil by the coating method. Effect of different ratios of the GOs on the electrochemical cycling performance of the coin-cells was discussed. GOs affect the specific capacity of the half-cells, but they are helpful for improving the cycle stabilities of the cells. The contributions of GOs modified NMC532 cathodes on suppressing thermal runaway of LIBs were studied by nail penetration tests, impact tests and scratch tests, respectively. The temperature distribution on the coin-cell surface was in-situ monitored by FLIR infrared camera technique during nail penetration tests. The residual surface morphology of the cathodes were observed by scanning electron microscopy after impact and scratch tests. All results indicate that GOs play an important role in inducing cracking nucleation, raising internal impedance and restraining heat generation when the internal shorting occurs in LIBs.

Keywords: Graphene oxides, impact test, nail penetration test, scratch test, thermal runaway

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