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Synthesis of Single Crystal LiNi0.6Mn0.2Co0.2O2 with Enhanced Electrochemical Performance for Lithium Ion Batteries (G)

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Lithium ion batteries are used in consumer electronics, electric vehicles and grid energy storage.1 New positive electrode materials like LiNi1-x-yMnxCoyO2 (NMC) are required to increase energy density, lower cost and increase lifetime. Conventional NMC has large secondary particles (10 - 15 μm) made of agglomerates of small grains (˜ 200 - 500 nm) and is thus called polycrystalline NMC.2 Commercially available single crystal NMC532 materials show particles that are about ˜3 μm in size, and were shown to have superior stability at high voltages and elevated temperatures compared to conventional polycrystalline NMC532 by the authors.2 Conventional LiNi0.6Mn0.2Co0.2O2 (NMC622) usually offers more capacity than NMC532 when charged to the same upper cut-off voltage so NMC622 is attractive.3 It is expected that single crystal NMC622 could also provide better performance than typical polycrystalline NMC622 materials. This work explores the synthesis of single crystal LiNi0.6Mn0.2Co0.2O2 and preferred synthesis conditions were found. A washing and reheating method was used to remove residual lithium carbonate after sintering. The synthesized single crystal NMC622 material worked poorly without the use of electrolyte additives in the electrolyte. However, with selected additives, single crystal cells outperformed the polycrystalline reference cells in cycling tests. It is our opinion that single crystal NMC622 has a bright future in the Li-ion battery field.

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