Electrochemical performance of materials synthesized by flame-assisted spray pyrolysis

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LiₓMO₂ (M= Mn, Ni, Co) composite materials with layered structures have received attention as high-capacity, low cost, and safe cathode materials for lithium-ion batteries [1]. The conventional synthesis method for these materials is co-precipitation, which has challenges associated with scale up [2]. Therefore a spray pyrolysis synthesis was developed by this group as a scalable, low cost production method [3]. Due to the formation mechanism of the particles, the product contains hollow spheres, which cause low bulk density [4-5]. Recently, Washington University in St. Louis and X-Tend Energy, LLC developed a scaled-up spray pyrolysis process for the synthesis of non-hollow, solid lithium transition metal oxide materials [6]. The method at present is capable of producing high quality battery materials at close to 50 gram/hour scale. In the present study layered LiₓMO₂ (M= Mn, Ni, Co) materials, spinel LiMn₂O₄ and similar oxides are produced and their electrochemical properties discussed:

Fig. 1 shows the XRD spectrum of Li₁₊₀.₄⁰Mn₀.₅₃Ni₀.₁₃Co₀.₁₃O₂. The material is phase pure and the spectrum is typical for the Li₁₊₀.₄⁰Mn₀.₅₃Ni₀.₁₃Co₀.₁₃O₂ material. Fig. 2 shows the cycle performance of Li₁₊₀.₄⁰Mn₀.₅₃Ni₀.₁₃Co₀.₁₃O₂ at C/10 and C/3 rate. The material displays capacities in excess of 200 mAhg⁻¹ after 100 cycles at 22°C. The results indicate that the material synthesized by flame assisted spray pyrolysis demonstrate excellent electrochemical performance and the method is a promising technique for synthesizing battery cathode materials in a scalable process.

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References:

Figure 1 XRD pattern of Li₁₊₀.₄⁰Mn₀.₅₃Ni₀.₁₃Co₀.₁₃O₂.

Figure 2 Cycle test results of Li₁₊₀.₄⁰Mn₀.₅₃Ni₀.₁₃Co₀.₁₃O₂ synthesized via flame assisted spray pyrolysis.

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