Study of the effects of annealing conditions and lithium content on the electrochemical performance of $Li_{1.2}Mn_{0.53}Ni_{0.13}Co_{0.13}O_2$ synthesized via spray pyrolysis

Miklos Lengyel[1], Gal Atlas[1], Wendong Wu[1], Xiaofeng Zhang[2], Dror Elhassid[3], Ilias Belharouak[2], Richard L. Axelbaum*[1]

[1]Department of Energy, Environmental & Chemical Engineering, Washington University in Saint Louis One Brookings Drive, Saint Louis, MO 63130

[2]Chemical Sciences and Engineering Division, Argonne National Laboratory, 9700 South Cass Avenue Argonne, IL 60439 USA

[3]X-tend Energy LLC, 1005 North Warson Road, Suite 201 St. Louis, MO 63132 USA

$xLi_2MnO_3 \cdot (1-x)LiMO_2$ (M= Mn, Ni, Co) materials with layered structures have received attention as high-capacity, low cost, and safe cathode materials for lithium-ion batteries [1-3]. Earlier a spray pyrolysis synthesis method was developed by this group for the production of layered, high energy cathode materials [4]. Synthesis conditions affect surface area, and the surface area of the powders can significantly influence the electrochemical properties. Increasing annealing duration will promote coarsening of the materials, and reduce the surface area. In the present study, the annealing conditions of the material are varied, and the effect on electrochemical performance is studied. The effect of excess lithium content on the structure is also studied, to account for potential evaporative lithium loss during the annealing process.

Figure 1 shows the initial cycling profile of $Li_{1.2}Mn_{0.53}Ni_{0.13}Co_{0.13}O_2$ annealed at 900°C for 2, 5 and 20 hours. Increasing the duration of the annealing reduces both the charge and the discharge capacity of the materials. Figure 2 compares the XRD patterns of the materials annealed for different durations. No phase separation can be observed, but the intensity of the peaks between 20-25° 2Θ, which correspond to the Li_2MnO_3-type domains in the structure, changes the annealing time. This indicates that the surface area reduction is coupled to a structural reorganization in the material. Figure 3 shows the effect of excess lithium content on the initial charge and discharge capacity of the material. Increasing the amount of lithium content by approximately 3.5% leads to a reduction in discharge capacity of the material. Results related to the effect of lithium content and the duration of the annealing on the stability of the material will be presented.

[1] *Corresponding author email: axelbaum@wustl.edu

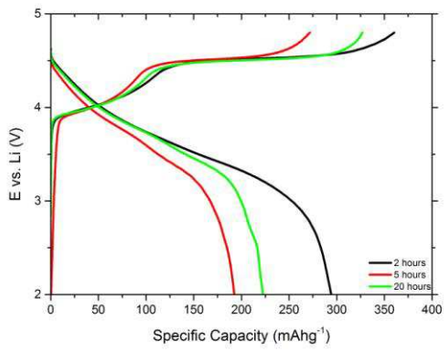

Figure 1. Initial charge and discharge profile of $Li_{1.2}Mn_{0.53}Ni_{0.13}Co_{0.13}O_2$ annealed at 900°C for 2, 5 and 20 hours

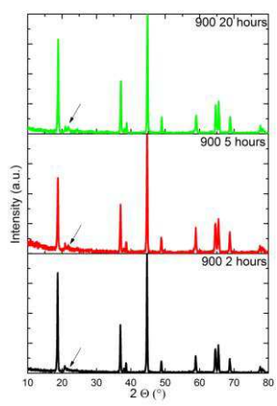

Figure 2 XRD spectra of $Li_{1.2}Mn_{0.53}Ni_{0.13}Co_{0.13}O_2$ annealed at 900°C for 2, 5 and 20 hours

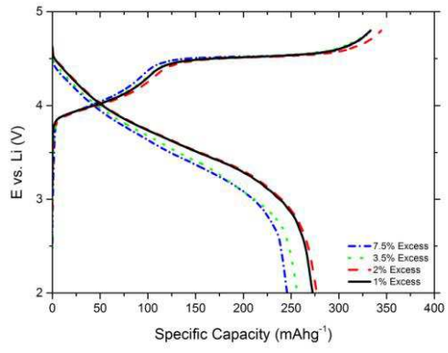

Figure 3 Initial charge and discharge profile of $Li_{1.2}Mn_{0.53}Ni_{0.13}Co_{0.13}O_2$ with various amount of excess Li

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