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Effects of Solvents and Starting Matierilas on Structural and Electrochemical Properties of $Li[Li_{1/5}Ni_{1/10}Co1_{/5}Mn_{1/2}]O_2$ Solid Solutions

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$Li[Li_{1/5}Ni_{1/10}Co1_{/5}Mn_{1/2}]O_2$ powders was synthesized using a solid state reaction. Listed on Table 1 are $Li[Li_{1/5}Ni_{1/10}Co1_{/5}Mn_{1/2}]O_2$ as function of formation type and solvents. All samples are indexed a layered structure based on a hexagonal α-NaFeO2 structure (space group: $R\bar{3}m$, 166) except for the superlattice ordering peaks between 20° and 25°. The stoichiometry of the samples prepared with acetone solvent was very close to the target values in Raman and XRD analysis, comparing to that with alcohol. The samples prepared with acetone solvent also delivered higher discharge capacities of the samples prepared with alcohol. Sample dependency on the solvent Samples prepared with alcohol were more dependent on solvent type than those with acetone. The initial discharge capacities of sample (a), (b), (c), (d), (e), and (f) were 107, 140, 119, 173, 155, and 158 mAh/g, respectively. The initial discharge capacity gradually increased with cycle number to be level off at certain capacity, and further cycling slowly decreased the capacity. The samples delivered the capacities of 137, 173, 153, 199, 190, and 199 mAh/g after 45 cycles with 0.063, 0.133, 0.014, 0.086, 0.057, and 0.055 %/cycle of for the capacity fading ratios for maximum capacity.

Table 1. Classification of $Li[Li_{1/5}Ni_{1/10}Co1_{/5}\ Mn_{1/2}]\ O_2$ precursor as function of starting materials and solvents.

Samples	**F. G**	**Solvent**
(a)	Hydroxide	Null
(b)	Hydroxide	Alcohol
(c)	Hydroxide	Alcohol
(d)	Acetate	Null
(e)	Acetate	Acetone
(f)	Acetate	Acetone

F.G: functional group

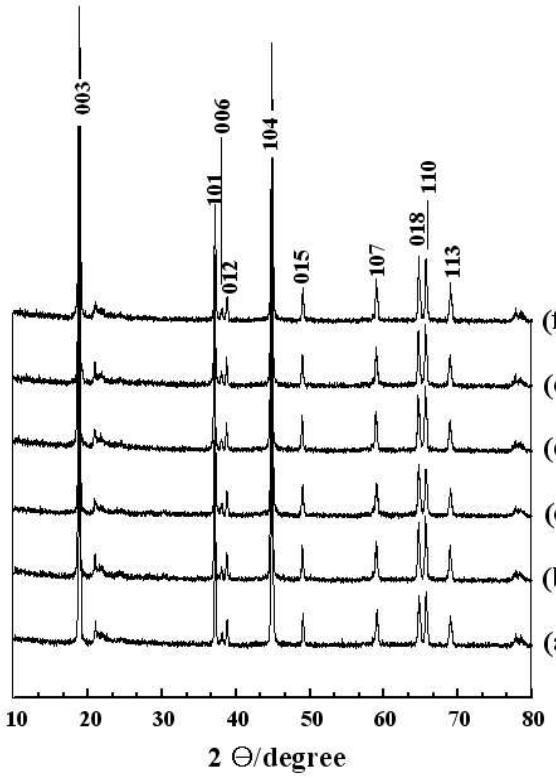

Fig. 1. XRD patterns for $Li[Li_{1/5}Ni_{1/10}Co1_{/5}Mn_{1/2}]\ O_2$ powders.

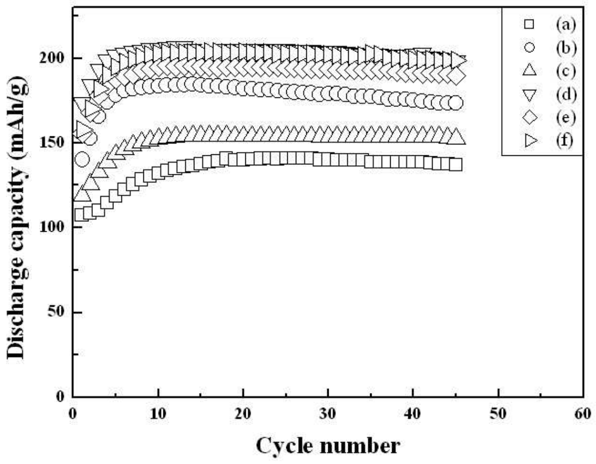

Fig. 2. Discharge capacity vs. cycle number for $Li[Li_{1/5}Ni_{1/10}Co1_{/5}Mn_{1/2}]O_2$/Li cells