Physical and Electrochemical Properties of $LiNi_{1-x}Co_xO_2$ Obtained From Different Preparation Method

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Objective

To Optimize Preparation Method and to Investigate Cycling Behavior of the $LiNi_{1-x}Co_xO_2$ (x = 0.1, 0.2 and 0.3) Cathode Materials

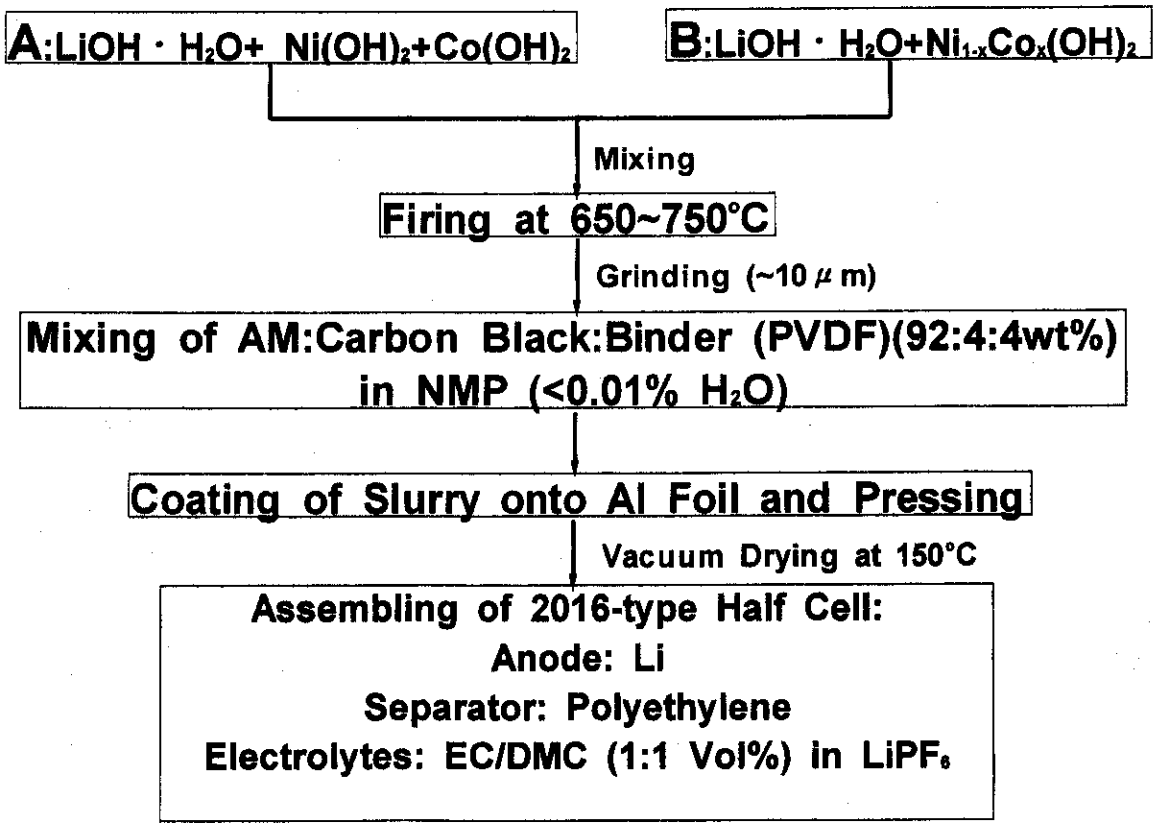
1. Optimization of Synthesis Method

- No Formation of CO_2 Gas
- Low Cost
- Mass Producible: Increasing Degree of Ni and Co Mixing

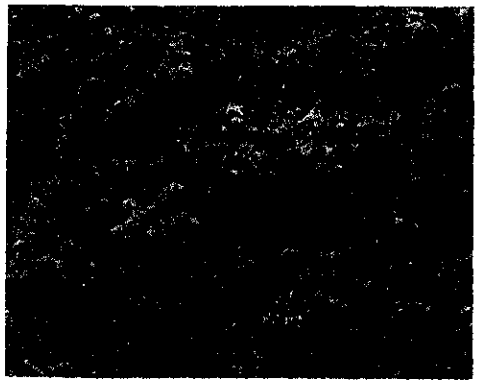
2. Investigation of Cycling Behavior of $LiNi_{1-x}Co_xO_2$

- High Specific Capacity
- Good Capacity Retention at 1C (=180mA/g)
- Low Irreversible Capacity (<20mAh/g)

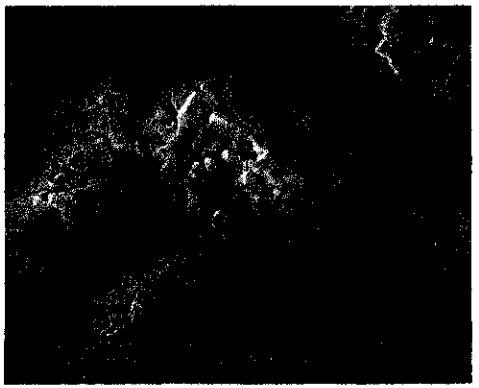
Experimental

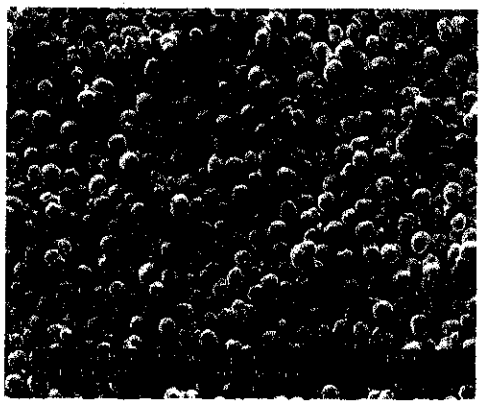


SEM Pictures of $LiNi_{1-x}Co_xO_2$ Prepared by Different Methods

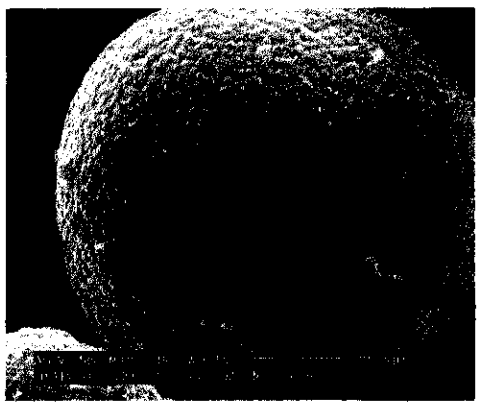


Method A
Tap density:
2.6cc/g



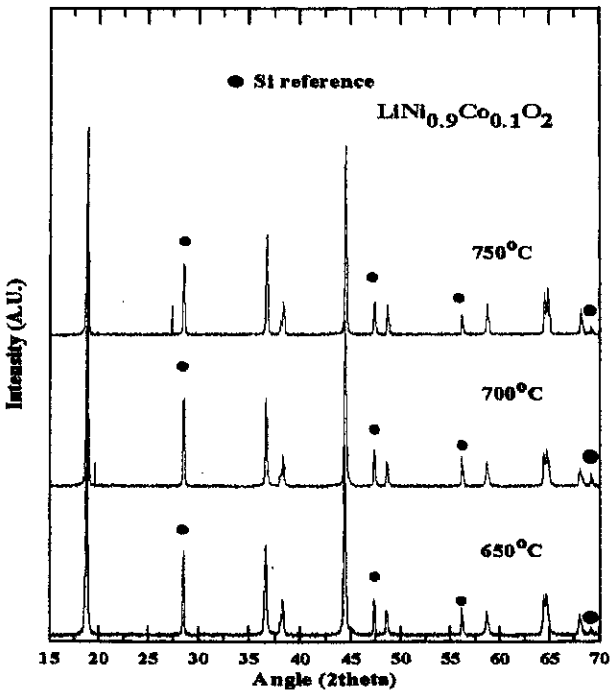


Method B
Tap density:
2.9cc/g

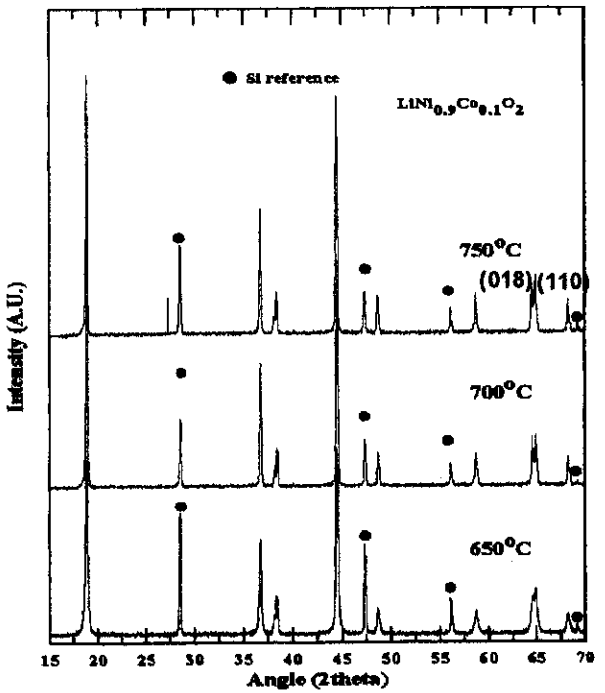


Comparison of the Powder XRD Patterns

Method A



Method B



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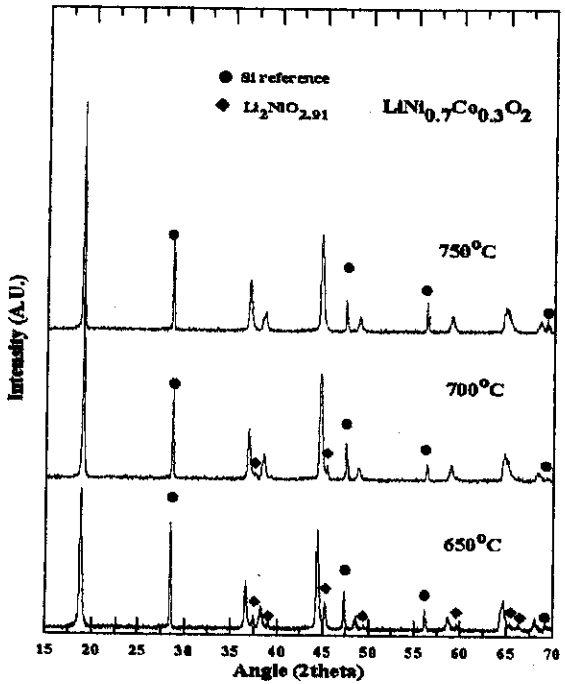
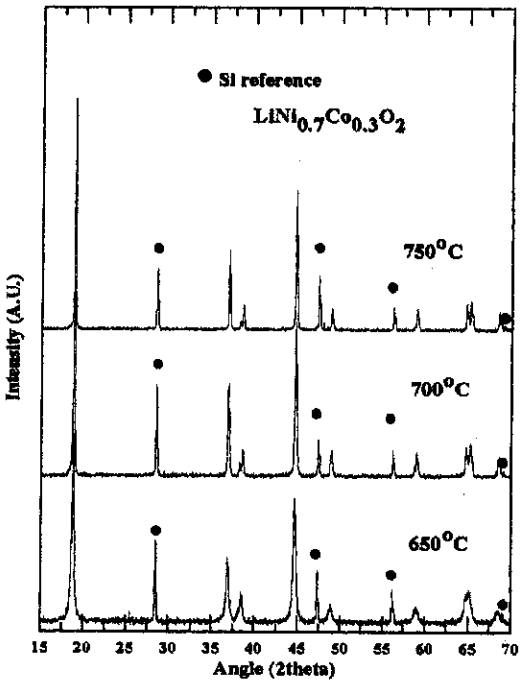


Method B



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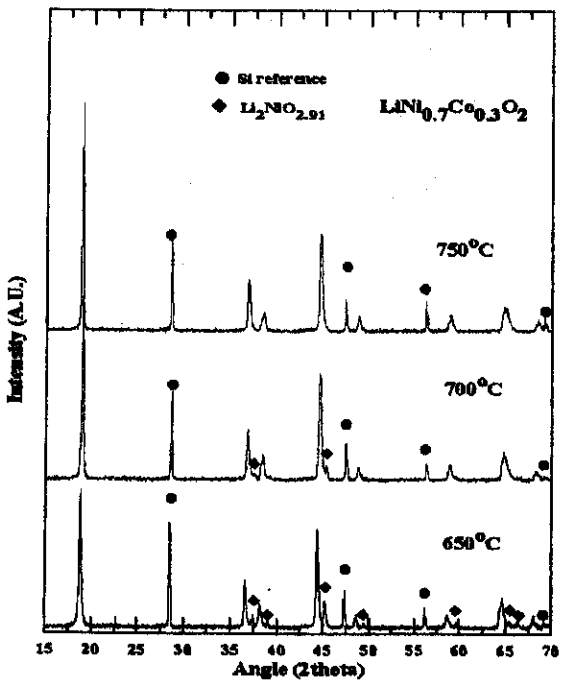
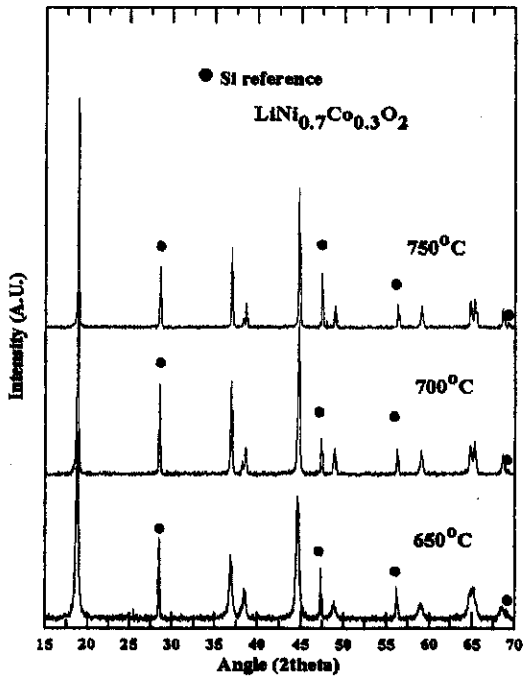


Method B

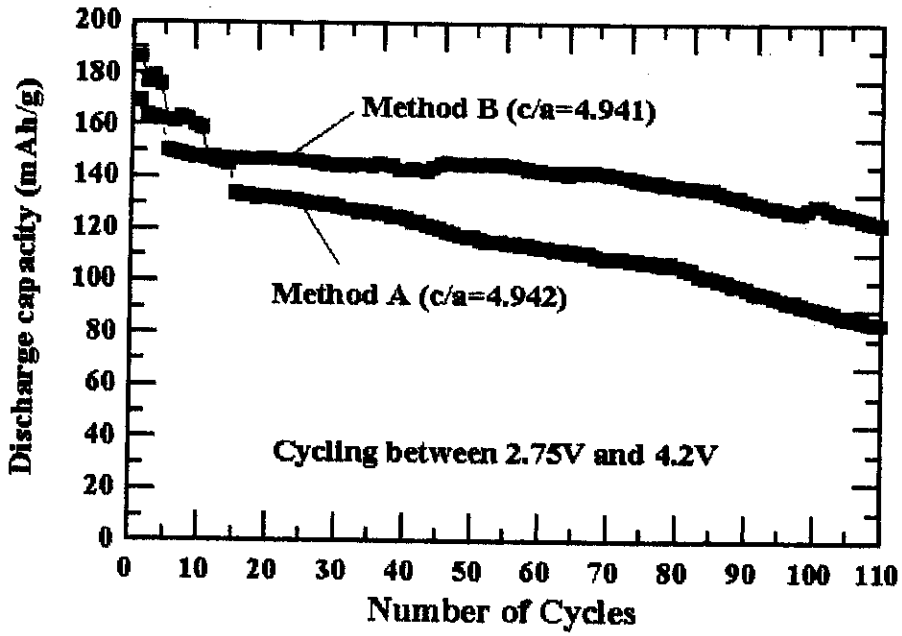


Comparison of a/c Values in the $LiNi_{1-x}Co_xO_2$ Materials Depending on Firing Temperature

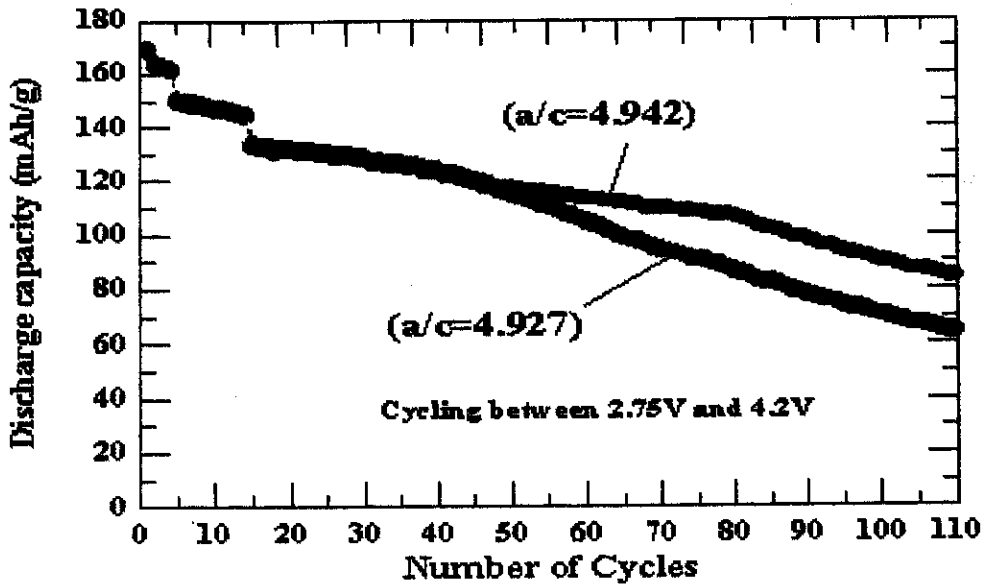
Method	A			B		
Compo-sition	$LiNi_{0.9}Co_{0.1}O_2$	$LiNi_{0.8}Co_{0.2}O_2$	$LiNi_{0.7}Co_{0.3}O_2$	$LiNi_{0.9}Co_{0.1}O_2$	$LiNi_{0.8}Co_{0.2}O_2$	$LiNi_{0.7}Co_{0.3}O_2$
650°C	4.930	4.918	4.909	4.933	4.934	4.938
700°C	4.942	[redacted]	4.924	4.936	4.94	4.951
750°C	4.942	[redacted]	4.910	4.934	4.941#	4.948

* $LiCoO_2$: 4.99, $LiNiO_2$: 4.935
* c/a is an indicative of structure anisotropy (cubic lattice: a/c=4.899)

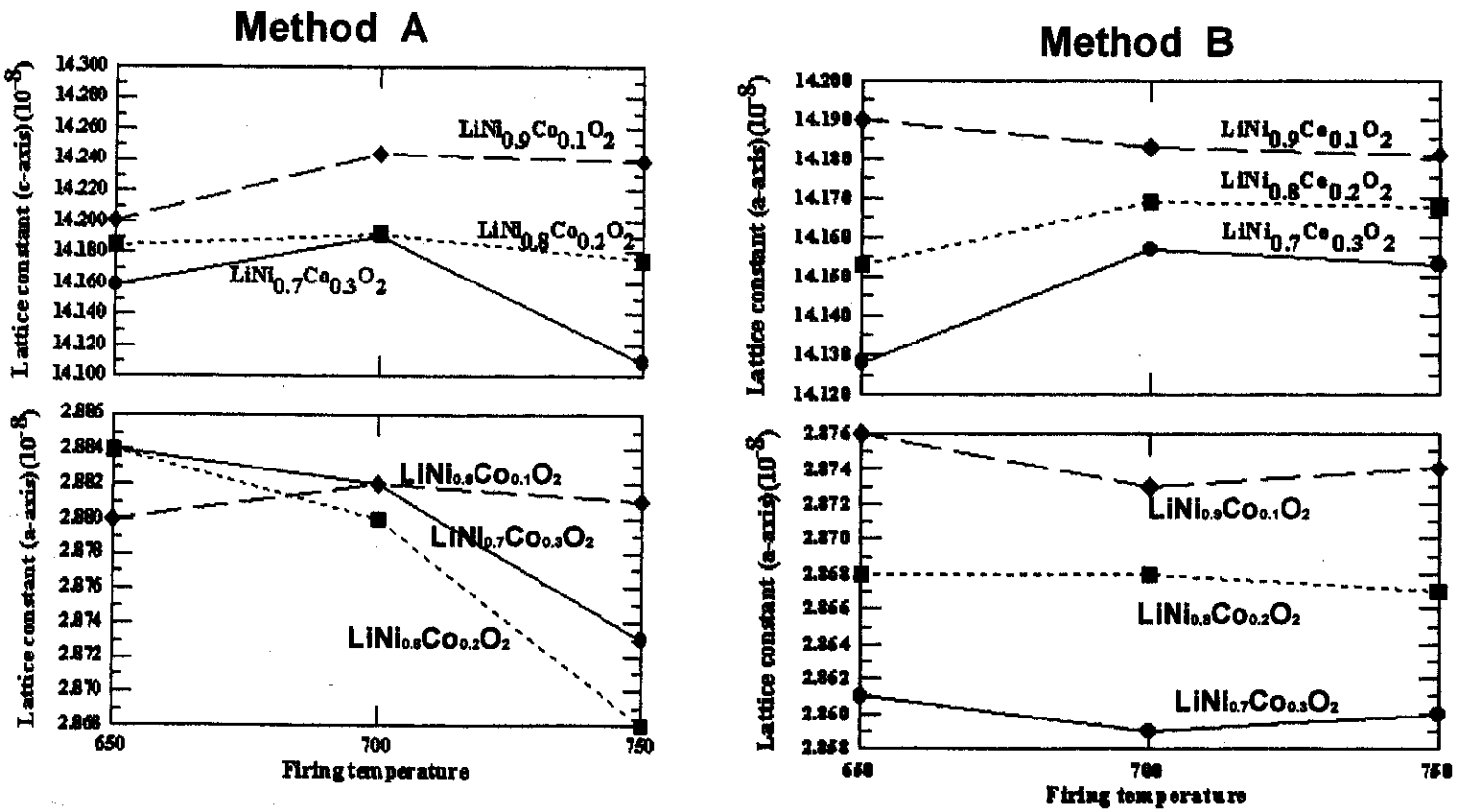
Cycling Behavior of $LiNi_{0.8}Co_{0.2}O_2$ Prepared by Different Methods



Cycling Behavior of $LiNi_{0.8}Co_{0.2}O_2$(A Methode) at Different C-rates

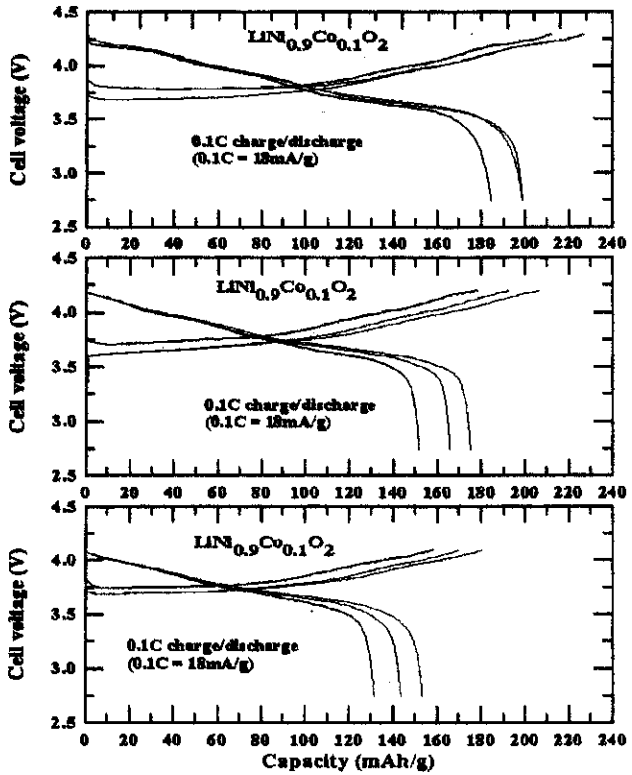


Comparison of Lattice Parameters as a Function of Firing Temperature

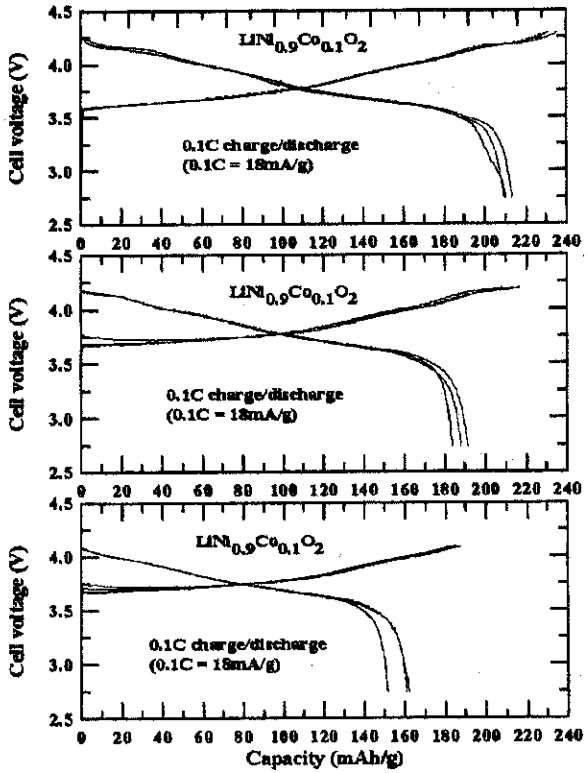


Comparison of the Cycling Curves in the First Cycle at Different Cut-off Voltages

Method A



Method B



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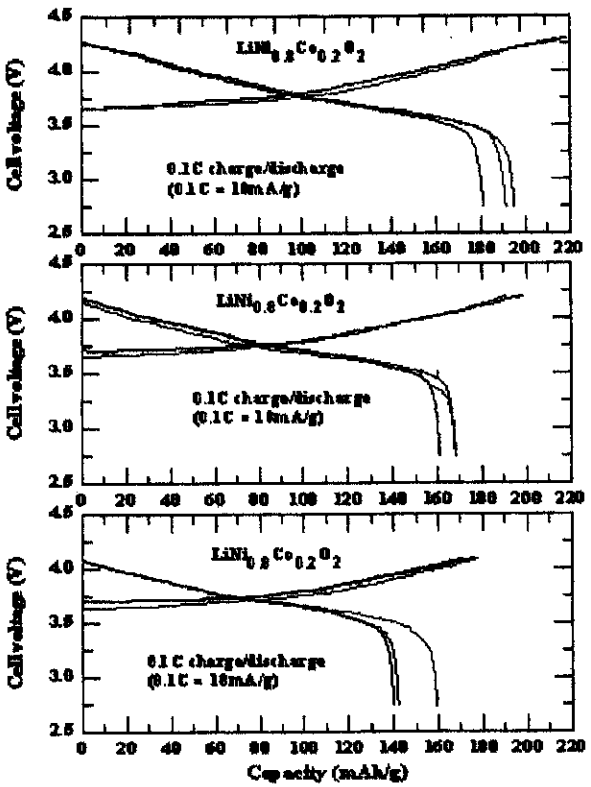
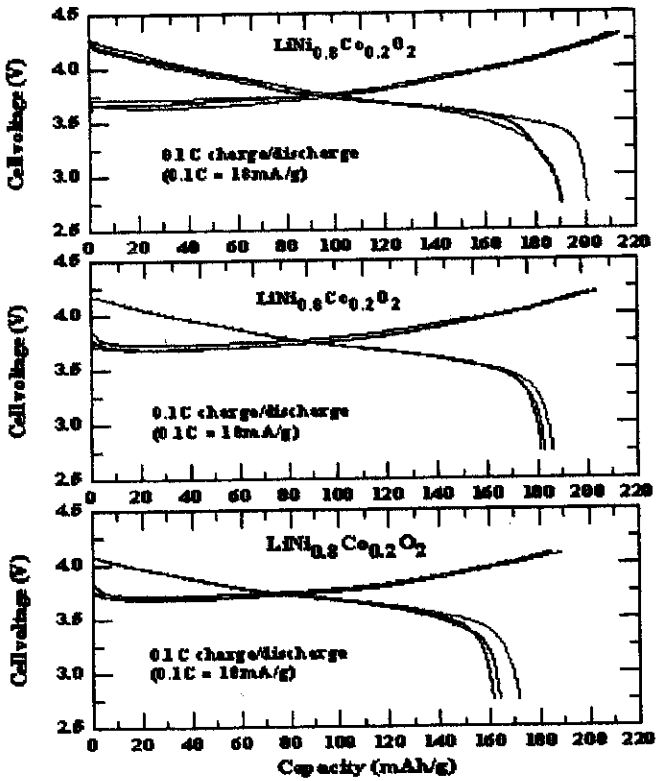


Method B



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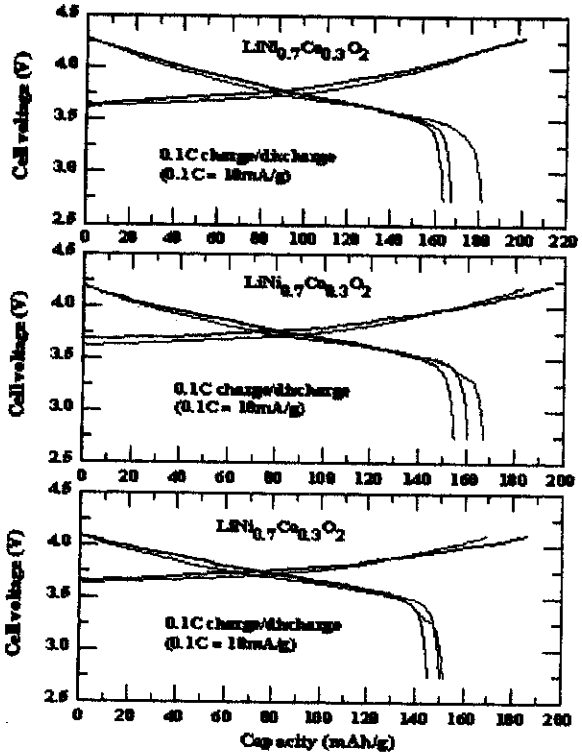
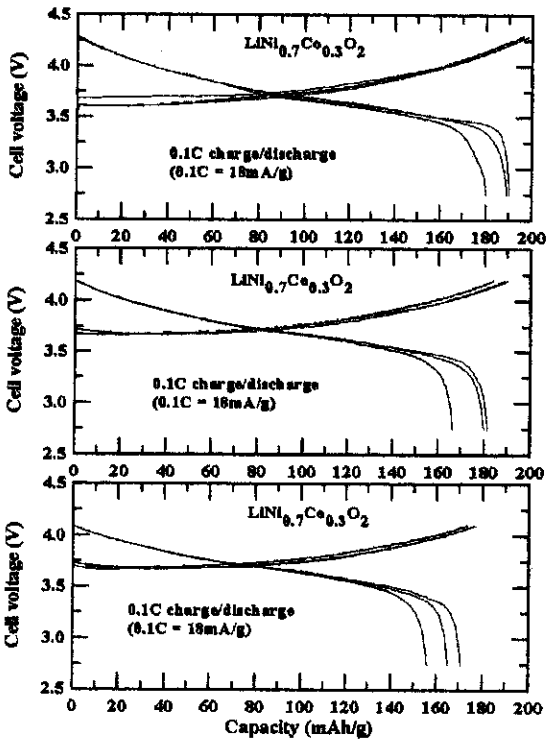
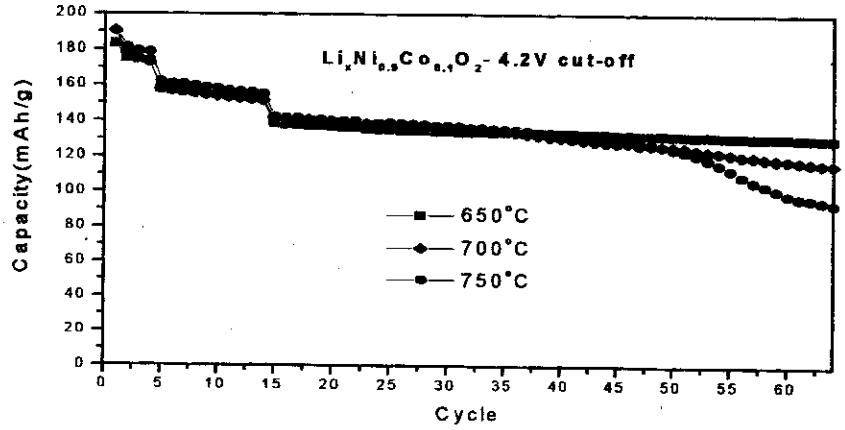
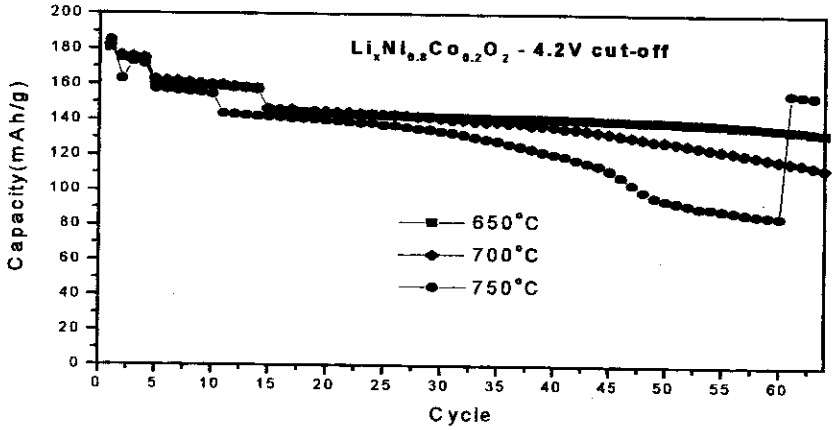


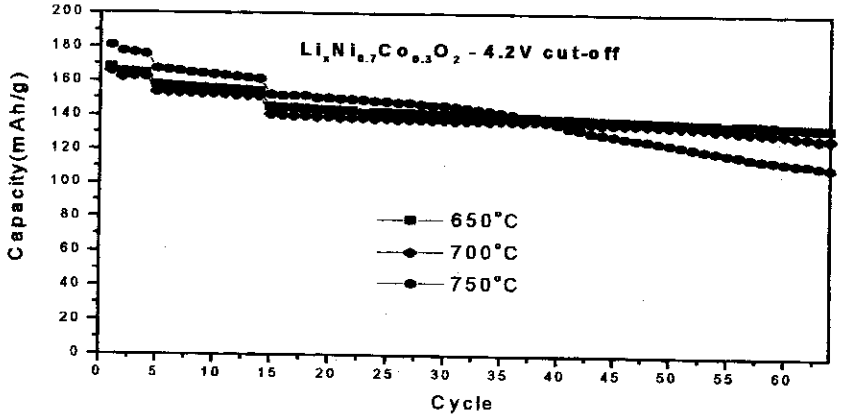
Method B



Comparison of the Cyclability at Different Composition







Conclusions

- $LiNi_{0.7}Co_{0.3}O_2$ Prepared by Method B Showed the Highest Values of a/c in the $LiNi_{1-x}Co_xO_2$ with x=0.1, 0.2 and 0.3

- $LiNi_{1-x}Co_xO_2$ with Less Cubic Characteristics (i.e., Higher Anisotropy) Showed Better Cyclability Than Those with Higher One → Increased Layered Characteristics

- $LiNi_{1-x}Co_xO_2$ Prepared by Method B Showed higher Capacity Retention and Better Cyclability Than Those Prepared by Method A

- $LiNi_{0.7}Co_{0.3}O_2$ Showed the Best Cycling Performance at Different Cut-off Voltages in the $LiNi_{1-x}Co_xO_2$ with x=0.1, 0.2 and 0.3 Prepared by Method B