

(19)  
(12)

(KR)  
(A)

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H01M 4/48

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(43)

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(21) 10 - 2001 - 0012827  
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(71) 20

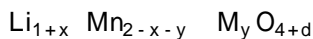
(72) 381 - 42 LG 5 - 103  
8 - 2 514 403  
694 101 1 01  
381 - 42 LG 6 402  
381 - 42 LG 8 510  
386 - 1 3 403

(74) :

(54) 2

2 , 2  
,  
; b) a) 2 1  
a) 2 .

[ 1 ]



x 0 1 0.12 , M Ti, V, Cr, Co, Ni, Mg, Zr, Fe, Gd, Ga 1 ,  
 , y 0 0.5 , d 0 0.04 ,

[ 2]

LiNi<sub>1-z</sub> Me<sub>z</sub>O<sub>2</sub>

2 , Me Ni, Co, V, Ti, Zr, Cr, Al, Cu, Zn, Ga, Gd 1  
 , z 0 0.7 .

2

1

, 2 , , , , , , ,

1 1

2 1 EDS (Energy Dispersive X - ray Spectrometer)

3 1 EDS .

4 1

5 1 7 , 1 2 (25 ) .

6 1 7 , 1 2 (55 ) .

2 , 2 .

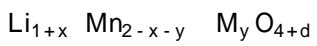
2 가 , 가 .  
 가 .  
 가 .

가 , 40 가 (cycle) 가  
 (Mn<sup>3+</sup>) 가 (dissolution) 가가 3 가  
 가 (doping)  
 Mn<sup>3+</sup>  
 Li<sub>2</sub>CO<sub>3</sub>, Na<sub>2</sub>CO<sub>3</sub>, K<sub>2</sub>CO<sub>3</sub> ( 60 (storage)  
 ( 5,733,685 ).

2

- a) 1 ;
- b) a) 2

[ 1 ]



1 ,

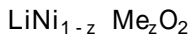
M Ti, V, Cr, Co, Ni, Mg, Zr, Fe, Gd, Ga 1 ,

x 0 0.12 (實數) ,

y 0 0.5 ,

d 0 0.04 ,

[ 2 ]



2 ,

Me Ni, Co, V, Ti, Zr, Cr, Al, Cu, Zn, Ga, Gd 1 ,

z 0 0.7 .

2 .

가 2 , 가 ,

2 , 2

Mn .

a) 1 ;

b) ) ;

) ;

) Ni, Co, V, Ti, Zr, Cr, Al, Cu, Zn, Ga, Gd

1 Me

a)

;

c) b)

2 .

, 2 % 가 , ) 1 , )  
 $\text{LiOH}$ ,  $\text{LiOH} \cdot \text{H}_2\text{O}$ ,  $\text{LiCH}_3\text{COO}$ ,  $\text{LiCHO}$   
 $\text{MnCO}_2$ ,  $\text{Mn}(\text{CH}_3\text{COO})_2$ ,  $\text{MnSO}_4$ ,  $\text{Mn}(\text{NO}_3)_2$ ,  $\text{Mn}(\text{OH})_2$  , )  $\text{MnO}_2$ ,  
 1 .

1 M ) M  
 M Ti, V, Cr, Co, Ni, Mg, Zr, Fe, Gd Ga  
 1 M ) Me  
 ) , ) , )  
 , )  
 1 , )  
 Me 1  
 50 % 가 , 50 % 가 0.05 % 0.05  
 ,  
 :  
 가 ) 가 ( sol) 가 가  
 a) 가 가  
 a) ,  
 (sol) .  
 00 가 0.05 , 3.0 /gH ( 10 % ) 50 150 가 , 400 9  
 가 1 30  
 가  
 .  
 2 . 2 1  
 2 , 2  
 . ,  
 .  
 [ ]  
 1  
 ( )

$Li_{1.05} Mn_{1.95} O_4$  , 480 , 10 , 750 , 20  
 , 0.1 /gH  
 [Li]/[Mn]가 0.538 Li

( )

$Co(CH_3COO)_2$  ,  $LiCH_3COO$  , Ni 30  $Ni(CH_3COO)_2$  , Co  
 [Li]:[Ni+Co] 1:1 가 Ni:Co  
 7:3 1.5 %

( )

가 ,

( )

(tube type) 700 10  
 0.1 /gH

S(Energy Dispersive X - ray Spectrometer) 2 3 1 , ED

1 A , B Ni (A )  
 ( 2, 3), Ni

( )

hite) , (polyvinyledene fluoride:PVdF) , : : (grap

85:10:5

n - (n - methyl pyrrolidone:NMP) 가  
 (tape casting) , 130

(coin cell)

$LiPF_6$  1 , (ethylene carbonate:EC)  
 (ethylmethyl carbonate:EMC)가 1:2

( )

[Li<sub>2</sub>MnO<sub>4</sub>/LiPF<sub>6</sub> (1 M) in EC+2EMC/Li]

가	가	3.4	4.3 V	가	3.0	4.5 V	4
1			4.3 V		60	5	6
2							
1				Ni:Co	4:6		
3							
1				LiNi <sub>0.7</sub> V <sub>0.3</sub> O <sub>2</sub>			
4							
1							0.5 %
5							
1						400	10
6							
3 COO	Mn(CH <sub>3</sub> COO) <sub>2</sub>			LiCH <sub>3</sub> COO	Mn(CH <sub>3</sub> COO) <sub>2</sub>	[Li]/[Mn]가 0.538	LiCH
						480	10
						700	20
						0.1 /gH	
					Li <sub>1.05</sub> Mn <sub>1.95</sub> O <sub>4</sub>		
	Li <sub>1.05</sub> Mn <sub>1.95</sub> O <sub>4</sub>				1		
7							
6				Ni:Co	4:6		
1							
1	Li <sub>1.05</sub> Mn <sub>1.95</sub> O <sub>4</sub>						1
					1		
2							
6	Li <sub>1.05</sub> Mn <sub>1.95</sub> O <sub>4</sub>						1

[ 1 ]

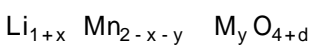
	2 (mAh/g)	60 1 (%)
1	126.7	8
2	127	10.6
3	127.3	15.2
4	127.5	16.4
5	127.4	20.5
6	126.5	7.5
7	126.1	5.5
1	128.5	24.7
2	129.2	32.8

5 (25 ) , 6 (55 )  
 1, 2 가  
 4.3 V 60 가  
 1 1??2 가 1 7  
 2  
 2

(57)

1.  
 2 ,  
 a) 1 ;  
 b) a) 2  
 :

[ 1 ]



1 ,  
 M Ti, V, Cr, Co, Ni, Mg, Zr, Fe, Gd, Ga 1 ,  
 x 0 0.12 (實數) ,



y 0 0.5 ,

d 0 0.04 ,

[ 2]

LiNi<sub>1-z</sub> Me<sub>z</sub>O<sub>2</sub>

2 ,

Me Ni, Co, V, Ti, Zr, Cr, Al, Cu, Zn, Ga, Gd 1 ,

z 0 0.7 .

2.

1 ,

b) a) 0.05 50 % .

3.

2 ,

a) 1 ;

b) ) ;

) ;

) Ni, Co, V, Ti, Zr, Cr, Al, Cu, Zn, Ga, Gd

1 Me

a)

;

c) b)

:

[ 1]

Li<sub>1+x</sub> Mn<sub>2-x-y</sub> M<sub>y</sub>O<sub>4+d</sub>

1 ,

M Ti, V, Cr, Co, Ni, Mg, Zr, Fe, Gd, Ga 1 ,

x 0 0.12 (實數) ,

y 0 0.5 ,

d 0 0.04 .

4.

3 ,

a)

) LiOH, LiOH · H<sub>2</sub>O, LiCH<sub>3</sub>COO, LiCHO<sub>2</sub>, LiCHO<sub>2</sub> · H<sub>2</sub>O, LiNO<sub>3</sub>

1 ;

) MnO<sub>2</sub>, MnCO<sub>2</sub>, Mn(CH<sub>3</sub>COO)<sub>2</sub>, MnSO<sub>4</sub>, Mn(NO<sub>3</sub>)<sub>2</sub>, Mn(OH)<sub>2</sub>

1

900 , 2 % 가 1 50 400 .

5.

4 ,

) Ti, V, Cr, Co, Ni, Mg, Zr, Fe, Gd Ga 1 M

6.

5 ,

) M M , , , , ,

7.

3 ,

b) ) LiOH, LiOH · H<sub>2</sub>O, LiCH<sub>3</sub>COO, LiCHO<sub>2</sub>, LiCHO<sub>2</sub> · H<sub>2</sub>O, LiNO<sub>3</sub>  
1 .

8.

3 ,

b) )

1

9.

3 ,

b) )

Me

1

Me

10.

3 ,

b)

c)

2

0.05 50 %가

a)

:

[ 2]

$\text{LiNi}_{1-z}\text{Me}_z\text{O}_2$

2 ,

Me Ni, Co, V, Ti, Zr, Cr, Al, Cu, Zn, Ga, Gd

1 ,

$z = 0 \sim 0.7$

11.

3 ,

b)

가

가

a)

12.

3 ,

b)

a)

13.

3 ,

c)

0.05

3.0 /gH

10 %

가

1 30

400

900

14.

1

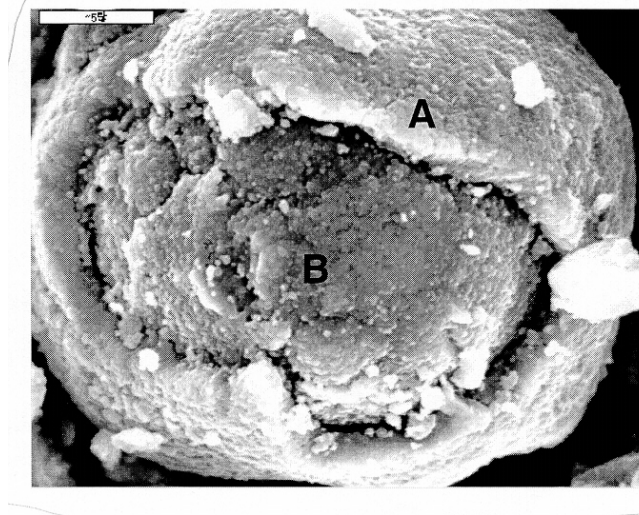
2 .

15.

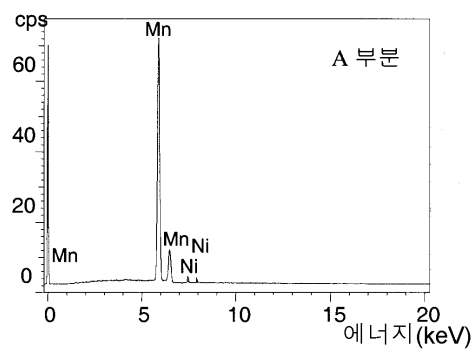
3

2 .

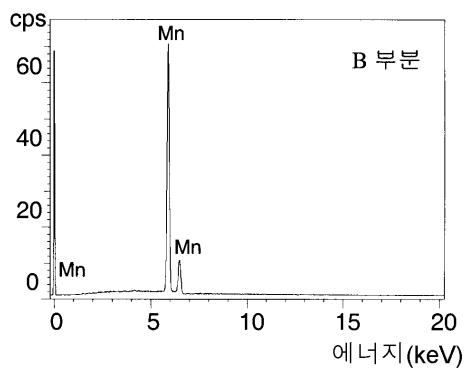
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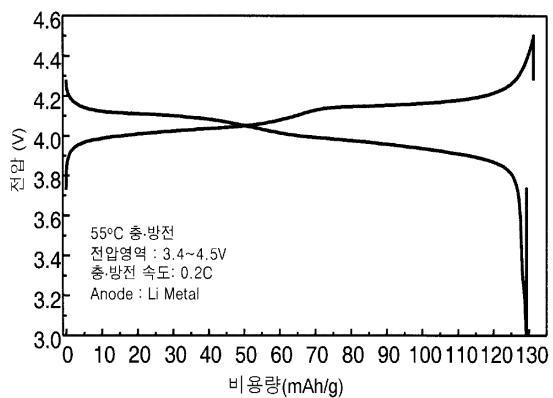
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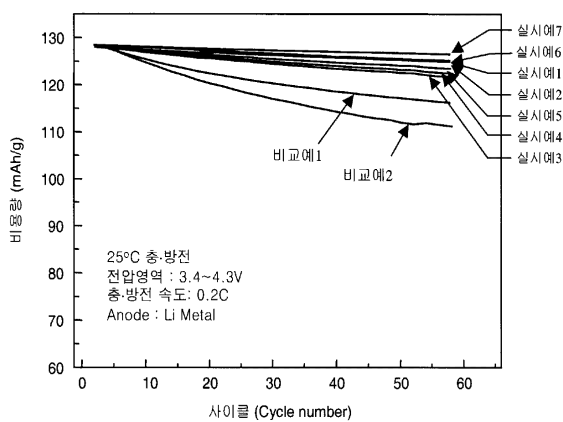
3



4



5



6

