

(19)
(12)

(KR)
(B1)

(51) 。 Int. Cl.7
H01M 4/36

(45)
(11)
(24)

2003 09 29
10-0399642
2003 09 17

(21) 10-2001-0065805
(22) 2001 10 24

(65)
(43)

2003-0033716
2003 05 01

(73)

575

(72)

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(74)

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(54)

(fracture toughness)가 3.5MPam^{1/2}

1

1
2
3

0.1C

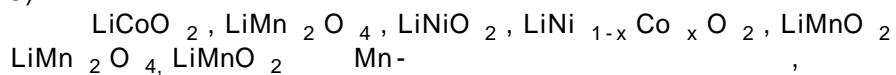
[]

[]

가 3.7V, 4V 3C

가 / 가 (dendrite)

가 (BOC) 가 가



, 가 LiNiO₂ 가 , 가 SONY

95% 가 LiCoO₂ , LiCoO₂

/ Li 가 Li /
2 , x가 0.5 (hexagonal) (monoclinic) LiNiO₂ LiCoO
, x가 0.5 (micro-cracks) (anistropic) (structural dama
ge)

가 Ni Co
x MO₂ (M Co, Ni Mn 5,292,601 LiCoO₂ Li
, x 0.5 1)가

acture toughness)가 3.5MPam^{1/2} ; - (fr

가 3.5MPam^{1/2} ; 가
 가 3.5MPam^{1/2} ;
 가 /
 0.2% a- c- 가
 가 (mechanical frac-
 ture) (point) 가
 SENB(single-edge-notched beam) ICL(indentation crack length)
 1

[1]

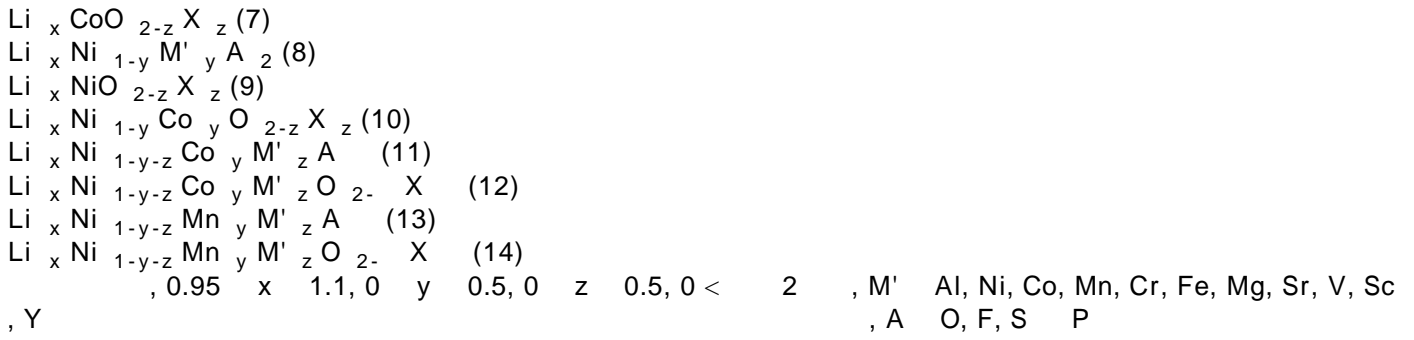
	MPam ^{1/2}
ZrAlO ₄	10 14
Al ₂ O ₃	2.7 4.2
TiO ₂	2.38
B ₂ O ₃	1.44
SiO ₂	0.70

1 가 ; 가
 3.5MPam^{1/2} 가
 3.5MPam^{1/2} 가
 Zr, Al, Na, K, Mg, Ca, Sr, Ni, Co, Ti, Sn, Mn, Cr, Fe V
 1

[1]
 ZrM_pO_q
 (M Al, Na, K, Mg, Ca, Sr, Ni, Co, Ti, Sn, Mn, Cr, Fe V
 p 1 5 가 , q 3 7 가 .)

.1μm 가 가 0.01μm 가 가 0.01 2μm 가 20,000 가 0
 2μm 가

- 가 (2) (14)가
- Li_xMn_{1-y}M'_yA₂ (2)
- Li_xMn_{1-y}M'_yO_{2-z}X_z (3)
- Li_xMn₂O_{4-z}X_z (4)
- Li_xMn_{2-y}M'_yA₄ (5)
- Li_xCo_{1-y}M'_yA₂ (6)



$x, 0.95 < x < 1.1, 0 < y < 0.5, 0 < z < 0.5, 0 < 2$, M' Al, Ni, Co, Mn, Cr, Fe, Mg, Sr, V, Sc
 , Y , A O, F, S P
 X F, S P
 1 20 μm 3 15 μm
 (suspension)
 (dip coat)

- (1)
- LiCoO_2 10μm LiCoO_2 90:10
 ZrAlO_4 $\text{LiCo}_{1-a} \text{Zr}_b \text{Al}_c \text{O}_2$ (0<a 0.6, 0<b 0.2, 0<c 0.2)
 92:4:4 P, 100 2 400 10
 1M LiPF_6 가 (1:1) 100μm / Al-
 1.6cm
- (2)
- (3)
- 1:1:1 1
- (4)
- LiCoO_2 10μm LiNiO_2 1
- (5)
- LiCoO_2 13μm $\text{LiMn}_2 \text{O}_4$ 1
- (6)
- LiCoO_2 13μm $\text{LiNi}_{0.9} \text{Co}_{0.1} \text{Sr}_{0.002} \text{O}_2$ 1
- (7)
- LiCoO_2 10μm $\text{LiNi}_{0.8} \text{Mn}_{0.2} \text{O}_2$ 1
- (8)

LiCoO₂ 13μm Li_{1.03}Ni_{0.69}Mn_{0.19}Co_{0.1}Al_{0.07}Mg_{0.07}O₂ 1
 (1)
 10μm LiCoO₂ 1
 (2)
 (3)
 (4)
 (5)
 (6)
 10μm LiNiO₂ 1
 1 AES(Auger Electron Spectroscopy) 1
 가
 2 1 2 3 5 , 1 0.1C 3 5
 3 , 1 가 1 5 가 ZrAlO₄ 가 0.5C 1 1 5 3
 가
 가 가 /

(57)

1. ; (fracture toughness)가 3.5MPam^{1/2} ,
2. 가 Zr, Al, Na, K, Mg, Ca, Sr, Ni, Co, Ti, Sn, Mn, Cr, Fe
3. 1
 [1]
 ZrM_pO_q
 (M Al, Na, K, Mg, Ca, Sr, Ni, Co, Ti, Sn, Mn, Cr, Fe V
 p 1 5 가 , q 3 7 가 .)
4. 1 , , 가

5.

1 , - (2) (14)

- Li_xMn_{1-y}M'_yA₂ (2)
 - Li_xMn_{1-y}M'_yO_{2-z}X_z (3)
 - Li_xMn₂O_{4-z}X_z (4)
 - Li_xMn_{2-y}M'_yA₄ (5)
 - Li_xCo_{1-y}M'_yA₂ (6)
 - Li_xCoO_{2-z}X_z (7)
 - Li_xNi_{1-y}M'_yA₂ (8)
 - Li_xNiO_{2-z}X_z (9)
 - Li_xNi_{1-y}Co_yO_{2-z}X_z (10)
 - Li_xNi_{1-y-z}Co_yM'_zA (11)
 - Li_xNi_{1-y-z}Co_yM'_zO₂₋X (12)
 - Li_xNi_{1-y-z}Mn_yM'_zA (13)
 - Li_xNi_{1-y-z}Mn_yM'_zO₂₋X (14)
- (, 0.95 x 1.1, 0 y 0.5, 0 z 0.5, 0 < 2 , M' Al, Ni, Co, Mn, Cr, Fe, Mg, Sr, V, S , A O, F, S P .)
- X F, S P

6.

1 , - 20,000

7.

1 , 가 가

8.

1 , 가 0.01 2μm

9.

8 , 가 0.01 0.1μm

10.

- 가 ; ;

- 가 3.5MPam^{1/2} ,

11.

10 , 가 Zr, Al, Na, K, Mg, Ca, Sr, Ni, Co, Ti, Sn, Mn, Cr, Fe V

12.

10 , 1 가

[1]
 ZrM_pO_q
 (M Al, Na, K, Mg, Ca, Sr, Ni, Co, Ti, Sn, Mn, Cr, Fe V ,
 p 1 5 가 , q 3 7 가 .)

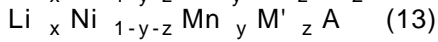
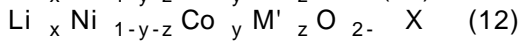
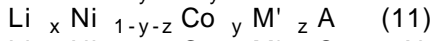
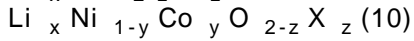
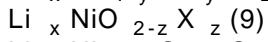
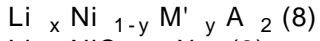
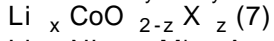
13.

10 , - , 가

14.

10 , - (2) (14)

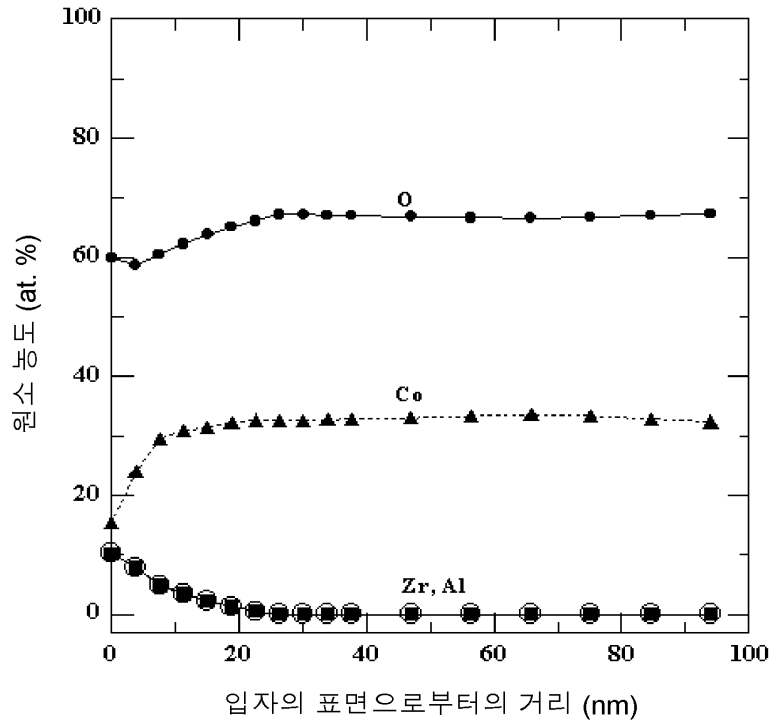
- Li_xMn_{1-y}M'_yA₂ (2)
- Li_xMn_{1-y}M'_yO_{2-z}X_z (3)
- Li_xMn₂O_{4-z}X_z (4)
- Li_xMn_{2-y}M'_yA₄ (5)



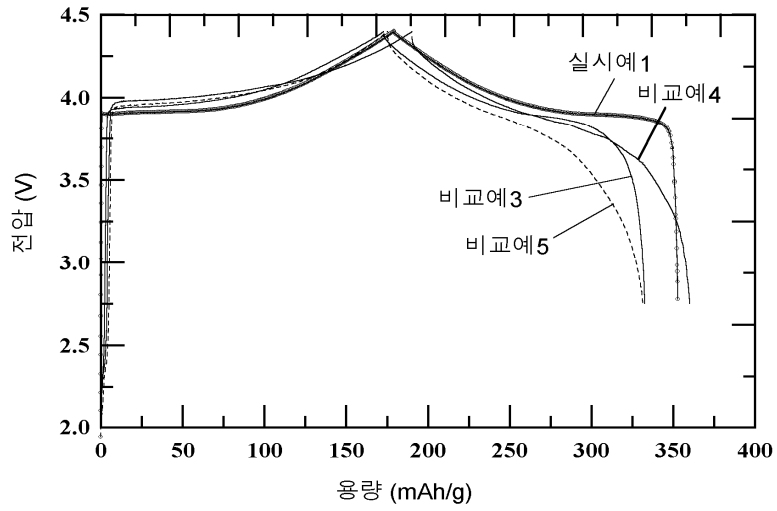
($x, y, z, 0.95 < x < 1.1, 0 < y < 0.5, 0 < z < 0.5, 0 < 2$, M' Al, Ni, Co, Mn, Cr, Fe, Mg, Sr, V, S, A O, F, S P.)

- 15. 10, -, 20,000
- 16. 10, 가
- 17. 10, 가 0.01 2 μ m
- 18. 17, 가 0.01 0.1 μ m
- 19. 10, 300 800
- 20. 10, 3 10

1



2



3

