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(21) 10-2002-0068671
(22) 2002 11 07

(30) 60/331,920 2001 11 20 (US)

(71) 19106-2399 , , 100

(72) , 19002, , 1676

가 , 19380, , 805

, 19002, , 701

(74)

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(54)

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,
(ready change-over) , .

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4A, 4B, 4C 4C

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102

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(ready change-over)

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5,281,745

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5,380,933

5,994,580)

6-228073)

6,214,195 B1.

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A_aM_mN_nX_xO_o

(A Mo W ,

A Mo W ,

M V Ce ,

N Te, Se Sb ,

X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb

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a=1 , m=0.01 - 1.0, n=0.01 - 1.0, x=0.01 - 1.0 o .)

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3

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4a, 4b, 4c 4d

가

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cm²/g

가

1cm²/g

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,

, 1cm²/g

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100

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가

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, 0.5eV

,

1.5eV

, 가

2.5eV

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가

가

0.001 ~100 가 /

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0.01

~10 가 /

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1

~1 가 /

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가

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0.001

~100 가

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가 , 가 ,

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가

250nm 100nm 가

20% 1cm²/g 가

(confinement size)

2

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1 101 가 101 102

01 102 101 101 102 가 101 101 1

2 1 202 201 202 201 2

202 101 2 101 2 가

101 101

1cm²/g 100cm²/g 1m²/g

가

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가

가

가

가

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DC

102

202

AC

3

300

305

305

302

3

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302

가

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301

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() 301

300

303

304

가

301

302가

304

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4

3

301

30

가

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, 가

가

300

4a, 4b, 4c

4d

400

가

()

401, 가

()

4a

()

402,

404

403,

401

403

405,

403

402

406

404

401

가

가

()

402

404

403

404

4B

407

407

4C

408

10-100

200

X 200

10's - 100's

408

409 가 . 4D , /
 , 409 410, - 411
 412 가 . 413 10-30nm , 0.5-40nm 10¹⁴ -10¹⁵ /m²
 414 407 .
 , 408 409 - .
 , 408 - . -
 .
 , (monolithic) 가
 , 가 0.29-0.13cm 8-50 /cm²
 , 1.5-100 /cm² 30 /cm²
 3 4600m² .
 , , 가
 , .

	Ag/
	Cu ₂ O, Bi
o- ,	V ₂ O ₅ , V ₂ O ₅ /TiO ₂ , V ₂ O ₅ -K ₂ S ₂ O ₇ /SiO ₂
	V ₂ O ₅ -P ₂ O ₅ /
	V ₂ O ₅ , V ₂ O ₅ -MoO ₃ , P ₂ O ₅ /
+ NH ₃	Bi , U-Sb
+ NH ₃	
+ NH ₃	V ₂ O ₅ -MoO ₃ /Al ₂ O ₃
m- + NH ₃	V ₂ O ₅ -MoO ₃ /Al ₂ O ₃
o- + NH ₃	V ₂ O ₅ -Sb ₂ O ₅
3- 4- + NH ₃ 3- 4-	V ₂ O ₅ -MoO ₃ /Al ₂ O ₃
+ NH ₃ HCN	Pt-Rh
+ HCl	CuCl ₂ /Al ₂ O ₃
+ NH ₃	
+ NH ₃	

$A_a M_m N_n X_x O_o$

(A Mo W ,

A Mo W ,

M V Ce ,

N Te, Se Sb ,

X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb ,

$a=1$, $m=0.01-1.0$, $n=0.01-1.0$, $x=0.01-1.0$ o .)

, $a=1$, $m=0.1-0.5$, $n=0.05-0.5$ $x=0.01-0.5$. , $a=1$, $m=0.15-0.45$, $n=0.05-0.45$, $x=0.01-0.1$. o ,
 . , o 3-4.7 .

$Mo_a V_m Te_n Nb_x O_o$ $W_a V_m Te_n Nb_x O_o$ 가
 a, m, n, x o .

1 , ,

\dot{A}, M, N, X, O .

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 . , ,
 /

$Mo_a V_m Te_n Nb_x O_o$ (, A Mo, M V, N Te X
 Nb) , 가

가 .

() ,

10-500mmHg , , , ,

75-150
 40-90

25-90

125-200
 10-760mmHg
 40-60

-40mmHg

10-350mmHg
 25-90

10
 가

4a, 4b, 4c 4d ,

3:1(:)

가

1-500hr⁻¹

350-850 , 400-700 , 500-640

0.5-30 , 1-25 , 1-15

200-400 , 275-325 , 15-8 , 1-3 , 2 , 1 , 200-400 , 15-8 , 1

1-3 , 500-750 , 550-650 , 15-8 , 가 가 2 가

1 , 1 , 2 , 2

(furnace) 가 , 가

가 ()

A_aM_mN_nX_xO_o (A, M, N, X, O, a, m, n, x o)

가

가

MoO₃, MoO₂, MoCl₅, MoOCl₄, Mo(OC₂H₅)₅, 가

가 , V₂O₅, V₂O₃, VOCl₃, VCl₄, VO(OC₂H₅)₃, 가

TeCl₄, Te(OC₂H₅)₅, Te(OCH(CH₃)₂)₄ TeO₂

Nb₂O₅, NbCl₅, Nb(OC₂H₅)₅

가

[illegible]

[illegible]

가

/

/

(57)

1.

$A_a M_m N_n X_x O_o$

(A Mo W ,

A Mo W ,

M V Ce ,

N Te, Se Sb ,

X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb ,

$a=1$, $m=0.01 - 1.0$, $n=0.01 - 1.0$, $x=0.01 - 1.0$ o .)

2.

1

$A_a M_m N_n X_x O_o$

(A Mo W ,

A Mo W ,

M V Ce ,

N Te, Se Sb ,

X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb

a=1 , m=0.01 - 1.0, n=0.01 - 1.0, x=0.01 - 1.0 o .)

3.

2 , A Mo ; M V ; N Sb ; X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, Ge, Sn, Li, Be, Hf, Pb, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb

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A_a M_m N_n X_x O_o

(A Mo W

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A Mo W

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M V Ce

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N Te, Se Sb

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X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb

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a=1 , m=0.01 - 1.0, n=0.01 - 1.0, x=0.01 - 1.0 o

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18.

17

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A_a M_m N_n X_x O_o

(A Mo W

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A Mo W

,

M V Ce

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N Te, Se Sb

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X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb

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a=1 , m=0.01 - 1.0, n=0.01 - 1.0, x=0.01 - 1.0 o

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19.

18 , A Mo ; M V ; N Sb ; X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, Ge, Sn, Li, Be, Hf, Pb, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb

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A_a M_m N_n X_x O_o

(A Mo W ,

A Mo W ,
M V Ce ,
N Te, Se Sb ,
X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb ,

a=1 , m=0.01 - 1.0, n=0.01 - 1.0, x=0.01 - 1.0 o .)

28.
27 ,
A a M m N n X x O o

(A Mo W ,
A Mo W ,
M V Ce ,
N Te, Se Sb ,

X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb ,

a=1 , m=0.01 - 1.0, n=0.01 - 1.0, x=0.01 - 1.0 o .)

29.
28 , A Mo ; M V ; N Sb ; X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, Ge, Sn, Li, Be, Hf, Pb, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb .

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A_a M_m N_n X_x O_o

(A Mo W

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A Mo W

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M V Ce

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N Te, Se Sb ,

X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb ,

a=1 , m=0.01 - 1.0, n=0.01 - 1.0, x=0.01 - 1.0 o .)

45.

44 ,

A_a M_m N_n X_x O_o

(A Mo W ,

A Mo W ,

M V Ce ,

N Te, Se Sb ,

X Nb, Ta, Ti, Al, Zr, Cr, Mn, Fe, Ru, Co, Rh, Ni, Pt, Bi, B, In, As, Ge, Sn, Li, Na, K, Cs, Fr, Be, Mg, Ca, Sr, Ba, Hf, Pb, P, Pm, Eu, Gd, Dy, Ho, Er, Th, Yb, Lu, Au, Ag, Pd, Ga, Pr, Re, Ir, Nd, Y, Sm Tb ,

a=1 , m=0.01 - 1.0, n=0.01 - 1.0, x=0.01 - 1.0 o .)

46.

43 ,

47.

43 ,

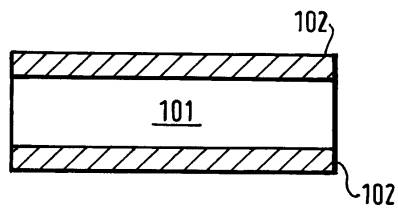
48.

43 ,

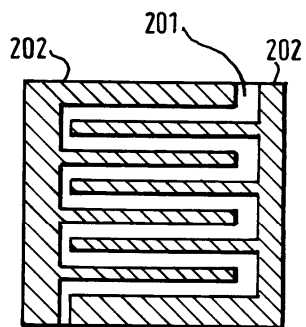
49.

43 ,

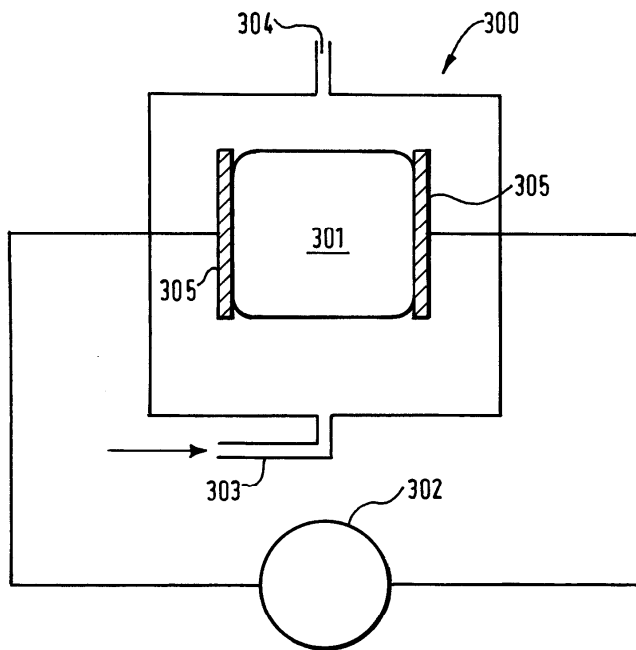
1



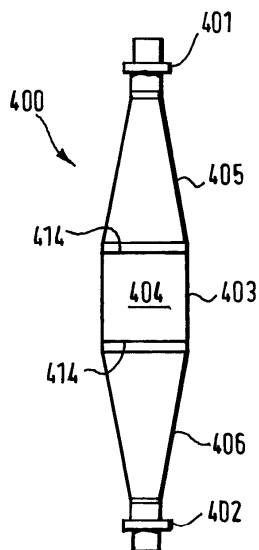
2



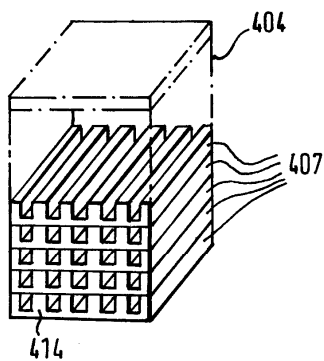
3



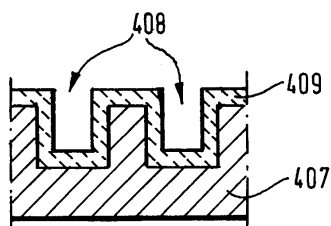
4a



4b



4c



4d

