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(73) 가 가
가 가
가 가 1 - 15 - 30

(72) 가 가 1 - 15 - 30가 가
가 가 1 - 15 - 30가 가
가 가 1 - 15 - 30가 가

(74)

:

(54) -

10% 20% Al₂O₃ 37 63 (Young's modulus)/ 가 ,
, (2) , , (1) , - , -

cording) (Young's modulus) , (ramp loading system) (glass - ceramic) (near contact re
 (specific gravity) 가

가 (film)

가 (multi media) , (用途展開)가 가

가 가 가 가 가

性, flatness), (平滑性, smoothness) (projection) (spot) (平坦
 (hardness)가 가 가 가

5 - 32431 가 (alumino silicate) 8 - 48537 (SiO₂, - Al₂O₃, - Na₂O)

- (1) (强化) 가 ,
- (2) 가 Na₂O K₂O (elution) (barrier coating) 가 ,
- (3) (strength) 가 (amorphous) 83 GPa 가 ,

n) (spodumene) (crystal phases) , 9 - 35234 EP0781731A1 Li₂O - SiO₂ (comporitio (lithium disilicate) (crystal phases) (cristobalite) 가 100 GPa 가

phase) (spinel crystal) , 9 - 77531 (predominant crystal MgTi₂O₅ Si O₂ - Al₂O₃ - MgO - ZnO - TiO₂ , 93.4Gpa 160.11GPa 가

(Mg/Zn)Al₂O₃ / (Mn/Zn)₂TiO₄ Al₂O₃ 가 (原, base) (melting property) (耐失透性)

(GPa)/ 2.87 가 가

가 가 (contact reconding)

(deflection)

(GPa)/

= 37 63

가

(固溶體, solid solution), (2)

(spinel)

, (1)

(cordierite)

(enstatite),

(quartz),

가

(析出)

가

가

Young'

s 가

(GPa)/

= 37 63

, 10% 20%

Al₂O₃

Na₂O, K₂O, Li₂O PbO

가

(1)

, (2)

가

[1]

SiO ₂	40 - 60 %
MgO	10 - 20%
Al ₂ O ₃	10 - 20%
P ₂ O ₅	0 - 4%
B ₂ O ₃	0 - 4%
CaO	0.5 - 4%
BaO	0 - 5%
ZrO ₂	0 - 5%
TiO ₂	2.5 - 8%
Sb ₂ O ₃	0 - 1%
As ₂ O ₃	0 - 1%
F	0 - 3%
SnO ₂	0 - 5%
MoO ₃	0 - 3%
CeO	0 - 5%
Fe ₂ O ₃	0 - 5%

0.05 μ m 0.30 μ m

- 50 70 30 $\times 10^{-7}$ / 50 $\times 10^{-7}$ /

(Rmax) 가 3 9 (組度)(Ra) 100

(annealing) 650 750 (molding) (nucleation) 7

50 1050 (結晶化, crystallization)

가

(Mg / Zn)Al₂O₄, (Mg / Zn)₂TiO₄

1

Li Al Si 가 Si (eucryptite) (- Li₂O · Al₂O₃ · 2SiO₂)

가 10.000 rev/min 가 가

가 가 (GPa)/ = 37

63

가 , 1 12 650 750 ,
 , 1 12 750 1050 .

1 6 (No.1 No.17) ,
 3 (alumino - silicate) (No.2, S
 8 - 48537) No.1, Li₂O - SiO₂ - (9 - 35234)
 iO₂ - Al₂O₃ - MgO - ZnO - TiO₂ - (9 - 77531) No.3 ,
 (GPa)/ (Ra),
 (Rmax), - 50 +70 SS'

[2]

	1	2	3
SiO ₂	54.0	56.8	57.5
MgO	14.0	16.0	16.0
Al ₂ O ₃	19.5	17.0	14.0
P ₂ O ₅	-	-	1.0
B ₂ O ₃	-	1.0	2.0
CaO	2.0	2.2	2.5
BaO	2.0	-	-
ZrO ₂	-	-	0.5
TiO ₂	5.0	5.5	6.0
Sb ₂ O ₃	-	-	-
As ₂ O ₃	0.5	0.5	0.5
F	-	-	-
Fe ₂ O ₃	3.0	1.0	-
()	670	700	680
()	1000	950	930
	0.3 μm	0.3 μm	0.3 μm
	0.1 μm	0.1 μm	0.1 μm
(Young's modulus)(GPa)	135	128	143
(g/cc)	2.65	2.60	2.58
(GPa)/	50.9	49.2	55.4
Ra ()	9	7	8
Rmax ()	98	81	78
(× 10 ⁻⁷ /) (- 50 +70)	37	35	46

[3]

	4	5	6
SiO ₂	57.1	45.6	56.0
MgO	14.0	18.0	10.4
Al ₂ O ₃	17.9	19.5	15.0
P ₂ O ₅	-	3.0	-
B ₂ O ₃	3.0	2.5	3.0
CaO	2.0	2.0	3.8
BaO	-	0.5	-
ZrO ₂	-	-	-
TiO ₂	5.5	8.0	7.0
Sb ₂ O ₃	-	-	-
As ₂ O ₃	0.5	0.9	-
F	-	-	-
Fe ₂ O ₃	-	-	4.8
()	650	650	720
()	980	940	1000
	0.3 μm	0.3 μm	0.3 μm
	- 0.1 μm	- 0.1 μm	- 0.1 μm
(Young' s modulus)(GPa)	133	121	141
(g/cc)	2.64	2.50	2.90
(GPa)/	50.4	48.4	48.6
Ra ()	5	4	9
Rmax ()	64	48	94
(× 10 ⁻⁷ /) (- 50 + 70)	30	48	36

[4]

	7	8	9
SiO ₂	59.5	60.0	41.7
MgO	17.0	19.5	17.0
Al ₂ O ₃	12.0	10.9	18.7
P ₂ O ₅	3.0	0.9	3.9
B ₂ O ₃	2.0	1.5	1.0
CaO	0.5	-	3.8
BaO	2.0	-	-
ZrO ₂	-	-	2.8
TiO ₂	4.0	3.5	6.6
Sb ₂ O ₃	-	0.9	0.5
As ₂ O ₃	-	-	-
F	-	2.8	-
Fe ₂ O ₃	-	-	4.0
()	700	730	750
()	960	1000	1050
	0.3 μm	0.3 μm	0.3 μm
	- 0.1 μm	- 0.1 μm	- 0.1 μm
(Young's modulus) (GPa)	138	120	151
(g/cc)	2.81	2.60	2.65
(GPa)/	49.1	46.2	57.0
Ra ()	6	8	7
Rmax ()	70	78	67
(× 10 ⁻⁷ /) (- 50 + 70)	32	41	38

[5]

	10	11	12
SiO ₂	45.1	55.0	56.0
MgO	18.0	18.0	11.0
Al ₂ O ₃	19.5	10.0	14.5
P ₂ O ₅	3.0	1.0	2.0
B ₂ O ₃	2.5	3.5	3.0
CaO	2.0	3.0	4.0
BaO	0.5	1.0	4.0
ZrO ₂	-	5.0	-
TiO ₂	7.5	2.5	4.0
Sb ₂ O ₃	-	0.5	0.5
As ₂ O ₃	0.9	-	-
F	-	-	-
Fe ₂ O ₃	SnO ₂ = 1.0	MoO ₃ = 0.5	CeO = 1.0
()	650	750	670
()	940	1050	1050
	0.3 μm	0.3 μm	0.3 μm
	- 0.1 μm	- 0.1 μm	- 0.1 μm
(Young's modulus) (GPa)	121	143	122
(g/cc)	2.50	2.90	2.70
(GPa)/	48.4	49.3	45.2
Ra ()	4	6	8
Rmax ()	48	78	76
(× 10 ⁻⁷ /) (- 50 + 70)	48	36	41

[6]

	13	14	15
SiO ₂	55.5	50.0	56.2
MgO	18.0	13.0	11.0
Al ₂ O ₃	10.0	18.0	14.5
P ₂ O ₅	1.0	3.1	2.0
B ₂ O ₃	3.5	3.9	3.0
CaO	3.0	1.0	4.0
BaO	1.0	3.0	4.8
ZrO ₂	5.0	-	-
TiO ₂	2.5	7.5	4.0
Sb ₂ O ₃	0.5	0.5	0.5
As ₂ O ₃	-	-	-
F	-	-	-
Fe ₂ O ₃	-	-	-
()	750	670	670
()	1050	900	1050
	0.3 μm	0.1 μm	0.3 μm
	- 0.1 μm	- 0.1 μm	- 0.1 μm
(Young's modulus) (GPa)	143	120	122
(g/cc)	2.90	3.10	2.70
(GPa)/	49.3	38.7	45.2
Ra ()	6	5	8
Rmax ()	78	49	76
(× 10 ⁻⁷ /) (- 50 + 70)	36	42	41

[7]

	16	17
SiO ₂	55.0	53.5
MgO	15.0	15.0
Al ₂ O ₃	17.0	18.0
P ₂ O ₅	1.0	2.0
B ₂ O ₃	2.0	-
CaO	1.0	2.0
BaO	4.0	2.0
ZrO ₂	-	-
TiO ₂	4.5	7.0
Sb ₂ O ₃	0.5	-
As ₂ O ₃	-	0.5
F	-	-
Fe ₂ O ₃	-	-
()	700	700
()	950	970
	0.3μm	0.3μm
	- 0.1μm	- 0.1μm
(Young's modulus)(GPa)	128	134
(g/cc)	2.80	2.77
(GPa)/	44.4	48.4
Ra ()	7	6
Rmax ()	68	61
(× 10 ⁻⁷ /) (- 50 + 70)	37	30

[8]

	1	2	3
SiO ₂	62.0	78.5	43.0
MgO	-	-	-
Al ₂ O ₃	16.0	4.4	26.8
P ₂ O ₅	-	2.0	-
ZnO	-	-	23.0
Li ₂ O	7.0	12.5	-
	Na ₂ O 9.0	K ₂ O 2.8	K ₂ O 2.4
ZrO ₂	4.0	-	-
TiO ₂	-	-	-
Sb ₂ O ₃	0.5	0.2	-
As ₂ O ₃	-	-	-
SnO ₂	-	-	-
MoO ₃	-	-	-
CeO	-	-	-
	-	-	Ga ₂ O ₃ 4.8
()	-	450	800
()	-	850	950
	- -	0.10μm	0.10μm
	- -	0.30μm	- -
(Young's modulus)(GPa)	82	92	110.5
(g/cc)	2.54	2.51	3.24
(GPa)/	32.3	36.0	34.1
Ra ()	8	11	65
Rmax ()	86	140	679
(× 10 ⁻⁷ /) (- 50 + 70)	70	61	53

(carbonate) (nitrate)

1350 1450

1 12 650 750 1

12 750 1050

lapping) 10 60 5μm 30μm 가 (砥粒, 30 60

0.5μm 2μm 가

1 7 - , LiO₂

- SiO₂ , SiO₂ - Al₂O₃ - MgO - ZnO - TiO₂ -

O - TiO₂ 가 가 가 가 No.3 Li₂O - SiO₂ SiO₂ - Al₂O₃ - MgO - Zn (anisotropic)

(foreign matters), 가

가 가
가 가
가 가
가 가

(57)

1.

(Young's modulus) / = 37 63 Al₂O₃ = 10% 20%

2.

1 , Na₂O, K₂O, Li₂O PbO

3.

1 2 , (1)
(固溶體), (2)
1 , - , -

4.

1 , - , 0.05μm 0.30μm

5.

1 , - , -50 +70 가 30 × 10⁻⁷ /
50 × 10⁻⁷ /

6.

1 , - (Ra)()가 3 9 ,
(Rmax)가 100

7.

1 , 가 (原)

[9]

SiO ₂	40 - 60 %
MgO	10 - 20 %
Al ₂ O ₃	10 - 20 %
P ₂ O ₅	0 - 4 %
B ₂ O ₃	0 - 4 %
CaO	0.5 - 4 %
BaO	0 - 5 %
ZrO ₂	0 - 5 %
TiO ₂	2.5 - 8 %
Sb ₂ O ₃	0 - 1 %
As ₂ O ₃	0 - 1 %
F	0 - 3 %
SnO ₂	0 - 5 %
MoO ₃	0 - 3 %
CeO	0 - 5 %
Fe ₂ O ₃	0 - 5 %

8.

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;

650 750

,

가 750 1050

7

-

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9.

1

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