[0084] Table 1-1

Example No.	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10
Components, properties	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%
SiO_2	54.90	54.83	54.62	54.50	54.97	55.89	54.83	54.75	54.96	54.75
Al_2O_3	12.87	12.85	12.85	9.90	12.98	12.94	13.93	12.95	12.96	9.96
B_2O_3	2.97	2.96	3.92	4.95	1.00	0.00	0.00	0.00	0.00	1.00
MgO	20.80	20.85	22.25	25.80	22.00	21.95	21.95	22.89	21.94	21.95
CaO	0.00	3.95	1.47	0.00	3.00	3.00	3.00	3.00	4.00	3.00
SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZrO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Li_2O	3.00	0.00	0.00	0.00	3.00	3.00	3.00	3.00	3.00	3.00
Na_2O	1.00	3.95	3.92	3.96	1.00	1.00	1.00	1.00	1.00	1.00
K_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TiO_2	3.96	0.00	0.00	0.00	2.00	2.00	2.00	2.00	2.00	4.96
Y_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SnO_2	0.00	0.25	0.73	0.73	0.05	0.15	0.15	0.25	0.09	0.25
CeO_2	0.50	0.35	0.24	0.17	0.01	0.08	0.14	0.16	0.05	0.13
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
$SiO_2+Al_2O_3$	67.77	67.68	67.47	64.40	67.95	68.83	68.76	67.70	67.92	64.71
BaO+SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO+CaO+SrO+BaO	20.80	24.80	23.72	25.80	25.00	24.95	24.95	25.89	25.94	24.95
$Li_2O+Na_2O+K_2O$	4.00	3.95	3.92	3.96	3.99	4.00	4.00	4.00	4.00	4.00
$Li_2O/(Li_2O+Na_2O+K_2O)$	0.75	0.00	0.00	0.00	0.75	0.75	0.75	0.75	0.75	0.75
$Na_2O/(Li_2O+Na_2O+K_2O)$	0.25	1.00	1.00	1.00	0.25	0.25	0.25	0.25	0.25	0.25
SnO_2+CeO_2	0.50	0.60	0.97	0.90	0.06	0.23	0.29	0.41	0.14	0.38
(MgO+CaO)/(MgO+CaO+SrO+BaO)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MgO/(MgO+CaO+SrO+BaO)	1.00	0.84	0.94	1.00	0.88	0.88	0.88	0.88	0.85	0.88
Tg (°C)	667	694	696	689	680	689	689	687	685	664
α ($\times 10^{-7}$/°C)	50.0	52.3	51.5	54.3	50.2	52.1	51.3	51.9	53.3	53.3
Specific gravity	2.588	2.568	2.557	2.539	2.626	2.632	2.640	2.643	2.636	2.640
Young's modulus (GPa)	97.1	91.1	90.3	90.1	99.6	99.1	101.2	101.0	100.8	98.7
Specific elastic modulus (MNm/kg)	37.5	35.5	35.3	35.5	37.9	37.7	38.3	38.2	38.2	37.4
Holding test 1300°C 16hr	A	A	A	A	A	A	A	A	A	A
Holding test 1250°C 16hr	A	A	A	C	A	A	A	A	A	A
Bubble density rank	B	S	A	A	A	A	S	S	A	S

[0085] Table 1-2

Example No.	No.11	No.12	No.13	No.14	No.15	No.16	No.17	No.18	No.19	No.20
Components, properties	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%
SiO_2	54.90	52.80	50.92	54.68	55.32	53.55	58.64	59.82	59.80	59.92
Al_2O_3	12.96	13.93	14.91	13.90	14.05	12.80	16.98	14.93	14.90	14.98
B_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	22.00	22.95	22.90	22.89	23.01	24.70	10.00	9.95	9.94	9.98
CaO	3.00	3.00	3.00	3.00	0.00	0.00	10.00	9.95	9.94	9.98
SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZrO_2	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00
Li_2O	3.00	4.00	4.97	4.00	4.00	0.00	0.50	0.00	4.95	2.50
Na_2O	1.00	1.00	1.00	1.00	1.00	5.40	2.98	4.96	0.00	2.50
K_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00
TiO_2	2.00	2.00	2.00	0.00	2.00	1.57	0.00	0.00	0.00	0.00
Y_2O_3	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.00	0.00
P_2O_5	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SnO_2	0.09	0.20	0.20	0.36	0.15	0.63	0.30	0.25	0.30	0.09
CeO_2	0.05	0.12	0.10	0.17	0.08	0.37	0.10	0.14	0.18	0.05
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.01	100.00
$SiO_2+Al_2O_3$	67.86	66.73	65.83	68.58	69.37	66.35	75.62	74.75	74.70	74.90
BaO+SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO+CaO+SrO+BaO	25.00	25.95	25.90	25.89	23.01	24.70	20.00	19.90	19.88	19.96
$Li_2O+Na_2O+K_2O$	4.00	5.00	5.97	5.00	5.00	5.40	3.98	4.96	4.95	5.00
$Li_2O/(Li_2O+Na_2O+K_2O)$	0.75	0.80	0.83	0.80	0.80	0.00	0.13	0.00	1.00	0.50
$Na_2O/(Li_2O+Na_2O+K_2O)$	0.25	0.20	0.17	0.20	0.20	1.00	0.75	1.00	0.00	0.50
SnO_2+CeO_2	0.14	0.32	0.30	0.53	0.23	1.00	0.40	0.39	0.48	0.14
(MgO+CaO)/(MgO+CaO+SrO+BaO)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MgO/(MgO+CaO+SrO+BaO)	0.88	0.88	0.88	0.88	1.00	1.00	0.50	0.50	0.50	0.50
Tg (℃)	685	669	663	680	683	713	751	725	685	689
α ($\times 10^{-7}$/℃)	52.0	55.2	58.4	53.2	51.8	54.5	52.2	56.7	55.6	52.0
Specific gravity	2.608	2.652	2.659	2.617	2.624	2.618	2.610	2.581	2.576	2.579
Young's modulus (GPa)	96.9	102.2	103.2	100.3	101.3	93.8	90.1	89.5	94.6	92.7
Specific elastic modulus (MNm/kg)	37.2	38.5	38.8	38.3	38.6	35.8	34.5	34.7	36.7	35.9
Holding test 1300°C 16hr	A	A	A	A	A	A	A	A	A	A
Holding test 1250°C 16hr	A	A	A	A	A	A	A	A	A	A
Bubble density rank	A	S	S	S	A	A	S	A	S	A

[0086] Table 1-3

Example No.	No.21	No.22	No.23	No.24	No.25	No.26	No.27	No.28	No.29	No.30
Components, properties	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%
SiO_2	59.74	53.91	60.27	58.56	59.20	48.77	63.91	64.09	66.49	54.93
Al_2O_3	13.01	16.97	14.97	8.56	14.75	17.11	9.97	5.21	7.88	9.98
B_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	9.95	9.95	6.84	12.36	9.81	17.11	12.47	6.50	6.54	25.94
CaO	9.95	9.95	12.40	16.28	8.70	10.00	9.50	12.50	9.87	3.00
SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.93	0.00
BaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZrO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.00	0.00
Li_2O	0.00	0.00	0.00	2.50	6.91	0.00	1.00	2.00	0.00	3.00
Na_2O	6.95	8.98	4.95	1.00	0.00	6.95	3.00	3.30	4.34	1.00
K_2O	0.00	0.00	0.00	0.50	0.00	0.00	0.00	4.18	0.00	0.00
TiO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
Y_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SnO_2	0.25	0.15	0.37	0.25	0.50	0.06	0.15	0.07	0.65	0.00
CeO_2	0.15	0.08	0.20	0.00	0.13	0.00	0.00	0.15	0.30	0.15
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
$SiO_2+Al_2O_3$	72.75	70.88	75.24	67.12	73.95	65.88	73.88	69.30	74.37	64.91
BaO+SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.93	0.00
MgO+CaO+SrO+BaO	19.90	19.91	19.24	28.64	18.51	27.11	21.97	19.00	18.34	28.94
$Li_2O+Na_2O+K_2O$	6.95	8.98	4.95	4.00	6.91	6.95	4.00	9.48	4.34	4.00
$Li_2O/(Li_2O+Na_2O+K_2O)$	0.00	0.00	0.00	0.63	1.00	0.00	0.25	0.21	0.00	0.75
$Na_2O/(Li_2O+Na_2O+K_2O)$	1.00	1.00	1.00	0.25	0.00	1.00	0.75	0.35	1.00	0.25
SnO_2+CeO_2	0.40	0.23	0.57	0.25	0.63	0.06	0.15	0.22	0.95	0.15
(MgO+CaO)/(MgO+CaO+SrO+BaO)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	1.00
MgO/(MgO+CaO+SrO+BaO)	0.50	0.50	0.36	0.43	0.53	0.63	0.57	0.34	0.36	0.90
Tg (℃)	695	692	725	726	675	692	693	628	685	676
α ($\times 10^{-7}$/℃)	63.9	68.8	56.7	53.2	58.6	69.0	54.0	78.0	57.0	54.0
Specific gravity	2.575	2.598	2.581	2.600	2.576	2.600	2.560	2.610	2.610	2.650
Young's modulus(GPa)	88.0	89.0	89.5	91.0	94.6	94.0	90.0	85.0	87.0	102.0
Specific elastic modulus (MNm/kg)	34.2	34.3	34.7	35.0	36.7	36.2	35.2	32.6	33.3	38.5
Holding test 1300°C 16hr	A	A	A	A	A	A	A	A	A	A
Holding test 1250°C 16hr	A	A	A	A	A	B	A	A	A	C
Bubble density rank	S	A	S	B	S	B	B	A	A	B

[0087] Table 1-4

Example No.	No.31	No.32	No.33	No.34	No.35	No.36	No.37	No.38	No.39	No.40
Components, properties	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%	mol%
SiO_2	63.98	53.84	53.77	53.83	53.90	55.92	55.91	53.89	53.89	53.44
Al_2O_3	5.16	16.92	16.93	16.93	16.97	16.97	16.97	16.98	16.97	16.80
B_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	6.47	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	12.78
CaO	12.39	9.95	9.95	9.95	9.95	9.95	9.95	7.98	5.99	2.95
SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZrO_2	2.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Li_2O	2.00	0.50	1.00	1.50	2.00	0.50	1.00	0.00	0.00	0.00
Na_2O	5.24	7.95	6.93	5.96	5.00	5.99	5.00	8.98	8.98	8.87
K_2O	0.00	0.50	1.00	1.50	2.00	0.50	1.00	0.00	0.00	0.00
TiO_2	1.20	0.00	0.00	0.00	0.00	0.00	0.00	2.00	4.00	3.94
Y_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SnO_2	0.35	0.20	0.30	0.25	0.15	0.15	0.15	0.15	0.15	0.87
CeO_2	0.25	0.20	0.17	0.13	0.07	0.07	0.07	0.07	0.07	0.35
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
$SiO_2+Al_2O_3$	69.14	70.76	70.70	70.76	70.87	72.89	72.88	70.87	70.86	70.24
BaO+SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO+CaO+SrO+BaO	18.86	19.90	19.90	19.90	19.91	19.91	19.91	17.93	15.94	15.73
$Li_2O+Na_2O+K_2O$	7.24	8.94	8.93	8.96	9.00	6.99	6.99	8.98	8.98	8.87
$Li_2O/(Li_2O+Na_2O+K_2O)$	0.28	0.06	0.11	0.17	0.22	0.07	0.14	0.00	0.00	0.00
$Na_2O/(Li_2O+Na_2O+K_2O)$	0.72	0.89	0.78	0.67	0.56	0.86	0.72	1.00	1.00	1.00
SnO_2+CeO_2	0.60	0.40	0.47	0.38	0.22	0.22	0.22	0.22	0.22	1.22
(MgO+CaO)/(MgO+CaO+SrO+BaO)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MgO/(MgO+CaO+SrO+BaO)	0.34	0.50	0.50	0.50	0.50	0.50	0.50	0.56	0.62	0.81
Tg (℃)	639	682	677	668	653	704	696	696	690	692
α ($\times 10^{-7}$/℃)	68.0	68.7	67.1	66.5	64.8	62.4	58.8	66.1	67.4	63.5
Specific gravity	2.650	2.608	2.606	2.609	2.611	2.603	2.610	2.601	2.587	2.568
Young's modulus(GPa)	90.0	90.9	91.3	92.5	93.3	91.8	92.4	87.7	87.8	88.3
Specific elastic modulus(MNm/kg)	34.0	34.9	35.0	35.5	35.7	35.3	35.4	33.7	33.9	34.4
Holding test 1300°C 16hr	A	A	A	A	A	A	A	A	A	A
Holding test 1250°C 16hr	A	A	A	A	A	A	A	A	A	C
Bubble density rank	S	S	S	S	A	A	A	A	A	A

[0088] Table 1-5

Example No.	No.41	No.42	No.43	No.44	No.45	No.46	No.47
Components, properties	mol%	mol%	mol%	mol%	mol%	mol%	mol%
SiO_2	53.75	59.89	59.95	59.73	59.91	59.95	60.52
Al_2O_3	16.98	14.96	15.00	14.90	14.96	15.16	15.20
B_2O_3	0.00	0.00	0.00	0.00	0.00	0.18	0.18
MgO	9.92	9.97	9.98	9.94	9.98	9.83	9.85
CaO	4.95	9.97	9.98	9.94	9.98	9.57	9.35
SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZrO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Li_2O	1.00	0.00	0.00	4.94	4.97	4.19	3.78
Na_2O	8.94	4.98	4.99	0.00	0.00	0.00	0.00
K_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TiO_2	3.96	0.00	0.00	0.00	0.00	0.78	0.78
Y_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SnO_2	0.15	0.15	0.07	0.45	0.12	0.21	0.21
CeO_2	0.35	0.08	0.03	0.10	0.08	0.13	0.13
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
$SiO_2+Al_2O_3$	70.73	74.85	74.95	74.63	74.87	75.11	75.72
BaO+SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO+CaO+SrO+BaO	14.87	19.94	19.96	19.88	19.96	19.40	19.20
$Li_2O+Na_2O+K_2O$	9.94	4.98	4.99	4.94	4.97	4.19	3.78
$Li_2O/(Li_2O+Na_2O+K_2O)$	0.10	0.00	0.00	1.00	1.00	1.00	1.00
$Na_2O/(Li_2O+Na_2O+K_2O)$	0.90	1.00	1.00	0.00	0.00	0.00	0.00
SnO_2+CeO_2	0.50	0.23	0.10	0.55	0.20	0.34	0.34
(MgO+CaO)/(MgO+CaO+SrO+BaO)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MgO/(MgO+CaO+SrO+BaO)	0.67	0.50	0.50	0.50	0.50	0.51	0.51
Tg (°C)	673	725	725	685	685	700	706
α ($\times 10^{-7}$/°C)	66.1	56.7	56.7	55.6	55.6	49.4	48.2
Specific gravity	2.593	2.581	2.581	2.576	2.576	2.590	2.590
Young's modulus (GPa)	89.3	89.5	89.5	94.6	94.6	95.2	94.2
Specific elastic modulus (MNm/kg)	34.4	34.7	34.7	36.7	36.7	36.7	36.4
Holding test 1300°C 16hr	A	A	A	A	A	A	A
Holding test 1250°C 16hr	A	A	A	A	A	A	A
Bubble density rank	A	A	A	S	S	A	A

[0089] Table 1-6

Number of Comp.Ex. or the like	Comp.Ex.1	Comp.Ex.2	Comp.Ex.3	Comp.Ex.4	Comp.Ex.5	Ref.Ex.1
Components, properties	mol%	mol%	mol%	mol%	mol%	mol%
SiO_2	67.1	59.8	63.3	68.9	70.15	53.97
Al_2O_3	15.2	17.4	13.1	16	15.26	17.15
B_2O_3	0	0	0	0	0	0.0
MgO	11.5	18.1	9.9	1.6	2.09	12.84
CaO	3.5	1.8	7.7	1.2	0	3.00
SrO	0	0.3	0	0	0.63	
BaO	1.1	0.2	1.7	0	0	
ZnO				1.6	0.48	
ZrO_2				0.6	0.53	
Li_2O				8.7	9.36	
Na_2O			3.2	0.8	0.63	9.00
K_2O						
TiO_2	0.80					4.00
Y_2O_3		1.2				
P_2O_5		0.7	0.5	0	0	
SnO_2	0.2	0.5		0.2	0.3	0.02
CeO_2	0.6		0.6	0.4	0.57	0.00
Total	100.00	100.00	100.00	100.00	100.00	99.98
$SiO_2+Al_2O_3$	82.30	77.20	76.40	84.90	85.41	71.12
BaO+SrO	1.10	0.50	1.70	0.00	0.63	0.00
MgO+CaO+SrO+BaO	16.10	20.40	19.30	2.80	2.72	15.84
$Li_2O+Na_2O+K_2O$	0.00	0.00	3.20	9.50	9.99	9.00
$Li_2O/(Li_2O+Na_2O+K_2O)$			0.00	0.92	0.94	0.00
$Na_2O/(Li_2O+Na_2O+K_2O)$			1.00	0.08	0.06	1.00
SnO_2+CeO_2	0.80	0.50	0.60	0.60	0.87	0.02
(MgO+CaO)/(MgO+CaO+SrO+BaO)	0.93	0.98	0.91	1.00	0.77	1.00
MgO/(MgO+CaO+SrO+BaO)	0.71	0.89	0.51	0.57	0.77	0.81
Tg (°C)	802	805	738	703	717	690
α ($\times 10^{-7}$/°C)	34.8	39.5	41.9	45.2	47.2	63.2
Specific gravity	2.579	2.655	2.604	2.48	2.465	2.564
Young's modulus (GPa)	92.6	98.2	86.4	87.9	87.5	88.1
Specific elastic modulus (MNm/kg)	35.9	37.0	33.2	35.4	35.5	34.4
Holding test 1300°C 16hr	C	C	B	B	B	A
Holding test 1250°C 16hr	C	C	C	C	C	C
Bubble density rank	A	B	B	A	A	E