

EXAMPLE 7

131.2 g of tetraethoxysilane (37.9 g in terms of SiO_2), 14.8 g (7.7 g in terms of P_2O_5) of the mixture of monoethyl phosphate and diethyl phosphate (molar ratio: 50/50), and 120 g of 0.15 mol/l aqueous solution of hydrochloric acid were mixed and stirred at room temperature. One hour later, 103.4 g of 50% aqueous solution of calcium nitrate (17.7 g in terms of CaO), 77.3 g of 30% aqueous solution of magnesium nitrate (6.3 g in terms of MgO) and 13.7 g of 50% aqueous solution of sodium nitrate (2.5 g in terms of Na_2O) were added, and then 36.0 g (corresponding to 30 volume %) of the same β -SiC whisker as used in Example 5 was added little by little with stirring. After stirring had been continued for 2 hours, the mixture was heated to 80° C. to form gel. The gel was dried and heat-treated in the same manner as in Example 5.

The heat-treated powder was pulverized by a ball mill and sintered in the same manner as in Example 5 except for using the temperature of 1100° C.

The obtained sintered body contained crystals of apatite and wollastonite besides the mixed silicon carbide.

The evaluation of dynamic properties of the sintered body revealed remarkable enhancement of the properties. Namely, the bending strength and fracture toughness of the sintered body not containing β -SiC whisker were 2300 kg/cm² and 1.8 MPa·m^{3/2} respectively. However, those of the sintered body obtained by the present example were 5200 kg/cm² and 5.3 MPa·m^{3/2} respectively.

EXAMPLE 8

In the composition ratio $\text{SiO}_2/\text{CaO}/\text{P}_2\text{O}_5=47/45/8$ (weight ratio), tetraethoxysilane, the mixture of monoethyl phosphate and diethyl phosphate (molar ratio: 50/50), and water in an amount of 12 times (molar ratio) the amount of tetraethoxysilane were mixed and stirred at room temperature for one hour, and then 50% aqueous solution of calcium nitrate was added.

The following additives No. 1, i.e. Y_2O_3 (2 mol %) doped ZrO_2 powder (average particle size: 0.3 μm) state and No. 2, i.e. β -SiC whisker (diameter: 0.1 to 1.0 μm , length: 20 to 200 μm) as reinforcing materials were added little by little to the thus prepared solution with stirring, in the respective amounts shown in the following stirred for one hour and heated to 80° C. to form gel. After cooling to room temperature, the gel was taken out and dried at 50° C. for one week. The dried gel was heated to 500° C. at 10° C./hr and held at the temperature for 10 hours to carry out heat treatment.

The heat-treated powder was pulverized by a ball mill, and sintered by a hot press in an argon atmosphere under the pressure of 400 kg/cm² at 1050° C. for 2 hour to obtain sintered body.

On the other hand, silicon dioxide, calcium carbonate and calcium hydrogen phosphate (dihydrate) were thoroughly mixed in powder state to the same composition ratio as above, placed in a platinum crucible, and heated at 1600° C. for one hour to melt the mixture. The melted mixture was poured into water for quenching, the quenched mixture was dried and pulverized by a ball mill to particle size of 44 μm (325 mesh) or less to obtain glass powder.

The following additives No. 3, i.e. the same additive as No. 1, and No. 4, i.e. the same additive as No. 2 were added as reinforcing materials to the above glass pow-

der in the same amounts with No. 1 and No. 2 respectively (as shown in the table), and mixed using a ball mill. The mixtures were sintered by a hot press in the same manner as in Nos. 1 and 2 to obtain sintered bodies.

The thus obtained No. 1 to No. 4 sintered bodies each contained crystals of apatite and wollastonite besides the respective additives.

The bending strength of these sintered bodies was measured, and the Weibull modulus was determined for evaluation of scattering of the strength (number of specimen: 40). The results are shown in the following table.

	No.	Additive (volume %)		Average flexural strength (kg/cm ²)	Weibull coefficient
		ZrO ₂ powder	Sic whisker		
Present invention	1	45	—	5100	19.6
Comparative example	2	—	30	4800	21.3
	3	45	—	4500	10.7
	4	—	30	4400	13.8

It is seen from the above result that the sintered bodies of the invention (Nos. 1 and 2) prepared using the sol-gel method had enhanced strength as compared with the sintered bodies (Nos. 3 and 4) prepared by mixing the reinforcing material with the glass powder obtained by the melting method and sintering the mixture. Further, it is also seen from the above result that according to the invention there can be obtained composite sintered bodies which have larger Weibull coefficient, i.e. much reduced scattering of the strength and thus are more homogeneous, which is a more remarkable effect than the above effect.

EXAMPLE 9

116.7 g of tetraethoxysilane (33.7 g in terms of SiO_2), 5.0 g (5.0 g in terms of P_2O_5) of the mixture of monoethyl phosphate and diethyl phosphate (molar ratio: 50/50), and 100 g of 0.2 mol/l aqueous solution of hydrochloric acid were mixed and stirred at 40° C. One hour later, 132.6 g of 50% aqueous solution of calcium nitrate (22.7 g in terms of CaO) was added, and then 23.7 g (corresponding to 20 volume %) of β -SiC whisker (diameter: 0.1 to 1.0 μm , length: 20 to 200 μm) and 45.0 g (corresponding to 20 volume %) of Y_2O_3 (3 mol %) doped ZrO_2 powder (average particle size: 0.8 μm) were each added little by little with stirring. After stirring had been continued for 2 hours, the mixture was heated to 80° C. and successively stirred. About 20 minutes later the reaction mixture thickened and gelled. After cooling to room temperature, the gel was taken out and dried at 50° C. for one week. After successive pulverization, the dried gel powder was heated to 500° C. at 20° C./hr and held at the temperature for 5 hours to carry out heat treatment.

The heat-treated powder was pulverized using a ball mill, and sintered by a hot press in an argon atmosphere under a pressure of 400 kg/cm² at 1200° C. for 2 hours.

The resulting sintered body contained crystals of apatite and wollastonite besides the mixed silicon carbide and zirconia.

The evaluation of dynamic properties of this sintered body revealed remarkable enhancement of the properties. Namely, the bending strength and fracture toughness of the sintered body not containing β -SiC whisker