

nor the ZrO₂ powder were 1700 kg/cm² and 1.4 MPa·m^{1/2} respectively. However, those of the sintered body obtained by the present example were 4200 kg/cm² and 7.8 MPa·m^{1/2} respectively.

EXAMPLE 10

51.9 g of tetramethoxysilane (23.3 g in terms of SiO), 14.3 g of 85% orthophosphoric acid (8.8 g in terms of P₂) and 105 g of water were mixed and stirred at room temperature. One hour later, 180.5 g of 50% aqueous solution of calcium nitrate (30.9 g in terms of CaO) and 65.0 g of 30% aqueous solution of magnesium nitrate (5.3 g in terms of MgO) were added. Then with continuation of stirring, 36.1 g (corresponding to 15 volume %) of Y₂O₃ (6 mol %) doped ZrO₂ short fibers (average diameter: 5 μm, average fiber length: 2000 μm) and 62.8 g (corresponding to 25 volume %) of Y₂O₃ (6 mol %) doped ZrO₂ powder (average particle size: 1 μm) were each added little by little. After continuation of stirring for 2 hours, the mixture was heated to 70° C. to form gel. After cooling to room temperature, the gel was taken out, dried at 50° C. for one week and then pulverized. The resulting powder was heated to 800° C. at 20° C./hr and held at the temperature for 2 hours to carry out heat treatment.

The heat-treated powder was pulverized by a ball mill, molded by a CIP under a water pressure of 4000 kg/cm², and sintered under an argon pressure of 9.8 kg/cm² at 1100° C. for 2 hours.

The resulting sintered body contained crystals of apatite and wollastonite besides the mixed 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 the ZrO₂ short fibers and the ZrO₂ powder as set out above were 2100 kg/cm² and 1.8 MPa·m^{1/2} respectively. However, those of the sintered body obtained by the present example were 4500 kg/cm² and 7.3 MPa·m^{1/2} respectively.

EXAMPLE 11

110.9 g of tetraethoxysilane (32.0 g in terms of SiO₂), 18.4 g (9.5 g in terms of P₂O₅) of the mixture of monoethyl phosphate and diethyl phosphate (molar ratio: 50/50) and 150 g of water were mixed and stirred at room temperature. One hour later, 131.3 g of 50% aqueous solution of calcium nitrate (22.4 g in terms of CaO) was added, and with continuation of stirring 15.9 g (corresponding to 15 volume %) of β-SiC whisker (diameter: 0.1 to 1.0 μm, length: 50 to 200 μm) was added little by little.

Separately, Y₂O₃ (3 mol %) doped ZrO₂ powder (average particle size: 0.3 μm) and α-Al₂O₃ powder (average particle size 0.4 μm) were mixed to a volume ratio of 7:3, calcined at 1400° C. for 2 hours, and pulverized by a ball mill to a particle size of 3 μm or less.

Then, 27.1 g (corresponding to 15 volume %) of the thus prepared mixed powder of the ZrO₂ and α-Al₂O₃ was added little by little to the above reaction solution with stirring.

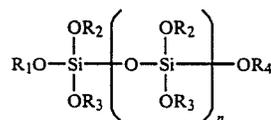
After continuation of stirring for 2 hours, the mixture was cooled, and after addition of 1.5 g of 10% aqueous solution of hydrofluoric acid the mixture was warmed to 40° C. with stirring to form gel. The resulting gel was dried, heat-treated and sintered by a hot press, in the same manner as in Example 9.

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

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 nor mixed powder of the ZrO₂ with α-Al₂O₃ were 2300 kg/cm² and 1.9 MPa·m^{1/2} respectively. However, those of the sintered body obtained by the present example were 5100 kg/cm² and 8.5 MPa·m^{1/2} respectively.

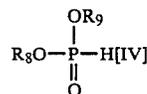
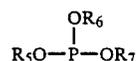
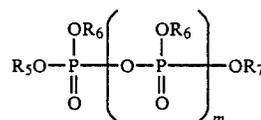
What is claimed is:

1. A process for preparing a glass or glass-ceramic composite sintered body which comprises reacting (A) at least one silicic acid ester represented by the general formula (I)



wherein R₁ to R₄ are each hydrogen or a group represented by C_xH_{2x+1}(OC₂H₄)_y— where x is 1 to 5, and y is 0 to 10, provided that R₁ to R₄ are not all hydrogen at the same time and n is 0 to 20;

(B) at least one phosphorus compound represented by the general formula (II), (III) or (IV):



wherein R₅ to R₉ are each hydrogen, an alkyl group having 1 to 5 carbon atoms, a phenyl group or an aralkyl group having 7 to 10 carbon atoms, and m is 0 to 10 and;

(C) at least one compound selected from the group consisting of water-soluble calcium salts; with water in an amount necessary for hydrolyzing the components (A)–(C) in the presence of the following component (D-1) and/or the following component (D-2) to form a gel, and drying, molding and then sintering the gel;

(D-1): at least one kind of ceramics fine particles having a composition different from a sintered body obtained from components (A) to (C) or having a crystal different from crystals formed in the sintered body,

(D-2): ceramic short fibers and/or whiskers.

2. The process of claim 1 wherein the ceramics fine particles are selected from the group consisting of Al₂O₃, ZrO₂, SiC, Si₃N₄, BN and sialon.

3. The process of claim 1 wherein the ceramics fine particles are polycrystals or single crystals having a melting point above the sintering temperature.