TTT (Time-Temperature-Transformation) Diagram of the SrO-GeO_2 System

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TTT diagram is necessary in glass forming systems to understand various phenomena such as phase separation and crystallization in supercooled liquid. A hot-thermocouple technique to establish the TTT diagram of glass forming systems has been proposed, which enables heating, temperature measurement, DTA and observation the state of the sample. Some TTT diagrams in the SrO-GeO_2 system have been determined by this method. In this system phase separation of nucleation-growth type was observed at high temperature in supercooled state. From the TTT diagram various cooling conditions can be determined for obtaining transparent glass and phase separated glasses of nucleation-growth, spinodal decomposition and crystallization types. It is concluded that the TTT diagram is important to develop " new glassy materials".

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Effect of Grain Morphology in Pressureless-Sintered Si_3N_4-Y_2O_3/Al_2O_3 on Leaching Behavior under Hydrothermal Conditions

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The purpose of this work is to study the effect of grain morphology in sintered Si_3N_4 on the leaching behavior under hydrothermal conditions. The pressureless-sintered Si_3N_4-Y_2O_3/Al_2O_3 specimens were produced using two kinds of commercial grade Si_3N_4 powders, i.e., prepared by the imide-decomposition method (specimen-A) and the silicon-nitridation method (specimen-B). Differences in microstructures were observed for sintered specimens from these Si_3N_4 starting powders, i.e., specimen-A resulted in a finer microstructure than specimen-B. Leaching test was carried out using an autoclave under the hydrothermal conditions at 300°C and 8.6 MPa for 1-10 days. The two specimens showed the similar trend of weight loss in leaching test, but larger weight loss was measured in specimen-B in the whole leaching time. A parabolic plot of weight loss suggested that the leaching mechanism consisted of two stages. SEM observation revealed that the both leached layers consisted of porous layer at the first stage and flakes on it at the second stage. The porous layer for specimen-A was finer than that for specimen-B and the traces of machining grooves was still visible on both porous layers. The results of this experiment showed that the leaching weight loss of sintered Si_3N_4 under hydrothermal conditions and the microstructures of the leached layer depended remarkably on the microstructural grain morphology of the sintered body generated by the starting powders and also on its mechanical history by grinding.

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Synthesis of Fine Particles of Hydrated Al_2O_3 and Al_2O_3-Coated Cr_2O_3 Composite Powders by Homogeneous Precipitation Method

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The homogeneous precipitation method using urea was applied to the synthesis of fine particles of hydrated Al_2O_3 and Al_2O_3-coated Cr_2O_3 composite powders from aqueous solutions of $Al_2(SO_4)_3$ as well as $Al(NO_3)_3$. Hydrated Al_2O_3 particles from $Al_2(SO_4)_3$ solution were spherical having average particle size of 0.6-2.7μm for the initial Al^{3+} concentrations of 0.006-0.072 M/l. Change of these products by heat-treatment was examined by powder X-ray diffraction measurement and DTA. It was found that those from the solutions with $[Al^{3+}] \leqq 0.036$ M/l were the coprecipitate of amorphous hydrated

Al_2O_3 and hydrated aluminum sulfate, and those from $[Al^{3+}] \geqq 0.036$ M/l contained basic aluminum sulfate too. By heating at 1200°C for 1 h, hydrated Al_2O_3 from $Al_2(SO_4)_3$ was transformed to α-Al_2O_3 without changing their original shape. Hydrated Al_2O_3 particles from $Al(NO_3)_3$ solution could be prepared by adding $(NH_4)_2SO_4$, and their average particle size decreased down to about 0.3μm. Hydrated Al_2O_3-coated Cr_2O_3 composite powders were prepared from both solutions of $Al_2(SO_4)_3$ and $Al(NO_3)_3$, and heat-treatment at 1200°C for 1 h converted them to α-Al_2O_3-coated Cr_2O_3 composite powders.

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Some Properties of β-Sialon and β-Sialon-SiC Composite Annealed under High N_2 Gas Pressure

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Bending strength, hardness, thermal expansion coefficient, fracture toughness and weight gain (1300°C, 100 h in air) of the β-sialon and β-sialon-50 wt% SiC composite hot-pressed at 1850°C and annealed at 1900° and 2000°C were measured.

(1) The strength and hardness of β-sialon and β-sialon-50 wt% SiC composite decrease with increase in annealing temperature.

(2) Fracture toughness of β-sialon and β-sialon-50 wt% SiC composite is about 3.0 $MNm^{-3/2}$ and 4.3 $MNm^{-3/2}$ respectively. They are independent of annealing temperature.

(3) Thermal expansion coefficient of β-sialon as hot-pressed and annealed at 1900° and 2000°C is 2.4-2.5×10^{-6}°C^{-1}. That of β-sialon-50 wt% SiC composite as hot-pressed and annealed at 1900°C is 3.0×10^{-6}°C^{-1} and annealed at 2000°C is 3.5×10^{-6}°C^{-1}.

(4) Weight gain of both β-sialon and β-sialon-50 wt% SiC oxidized at 1300°C for 100 h is nearly zero.

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Bending Strength of Hydroxyapatite Ceramics Containing α-Tricalcium Phosphate

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Hydroxyapatite powders containing coprecipitated tricalcium phosphate in an arbitrary ratio could be synthesized by mixing solutions of calcium nitrate and diammonium hydrogen phosphate at a definite reaction temperature and aging temperature. Effect of tricalcium phosphate addition on the bending strength of sintered hydroxyapatite was investigated using the synthesized hydroxyapatite powder. The bending strength of the sintered hydroxyapatite containing 17 mol% tricalcium phosphate was 1910 kgf/cm^2, equivalent to the value of about 25% higher than that of the sintered bodies of pure hydroxyapatite. The crystal phase of the polycrystalline body consisted of hydroxyapatite and α-tricalcium phosphate.

The Observation of Cristobalite Formed on the Oxidized Layer of Silicon Nitride by EPMA

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Hot-pressed silicon nitride test bars were oxidized in air flow at 1200°C for 480 h. The observations by composition and topography image of SEM indicate that cristobalite crystals of 1-4 μm are formed (appears as black spots) and cracks run in all directions all over the oxidized surface, and $Y_2O_3 \cdot 2SiO_2$ crystals are clearly convex and the SEM image of cristobalites