Properties of α-Sialon Ceramics

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α-Sialon ceramics in the system of Si_3N_4-AlN-Y_2O_3 were fabricated by pressureless sintering. The solid solubility range, microstructure and mechanical properties such as fracture strength, hardness, fracture toughness were measured. In the Y-α-Sialon ceramics, there existed a composition range containing a small amount of additive named "partially stabilized α-Sialon" in which α-Sialon and β-Si_3N_4 coexist. α-Sialon ceramics with excellent mechanical properties can be obtained in this composition range by controlling composition and microtexture.

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pp. 183–5

Fracture Energies of Sintered Boron Nitride

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Fracture energies of a sintered boron nitride were measured using chevron-notched compact tension type specimens. During stable crack growth unloading-reloading processes were repeated in order to evaluate the plastic deformation. From load P-loadpoint displacement u diagram, total fracture energy (work of fracture) γ_{WOF} was determined as 26.2 J/m^2 with error of less than 5%, close to a half of which (about 45%) was found to be dissipated by plastic deformation. The results were discussed in the relation with those on graphite materials.

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pp. 186–7

Wear of Hot-Pressed Aluminum Nitride

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Aluminum nitride ceramics were fabricated by hot-pressing at 1700°-2000°C, and their friction and wear properties were measured with a pin-on-disk tester. The sliding velocity dependence of wear was also investigated with a Sawin-type tester. AlN hot-pressed at 1700°C has some residual porosities, so its fracture toughness and Vickers hardness are relatively low. But they become almost constant for AlN hot-pressed above 1800°C. Substantial grain growth was observed with increasing hot-pressing temperature. The friction coefficient and specific wear rate measured with the pin-on-disk tester increased with increasing hot-pressing temperature. Wear particles consisting of small AlN grains may act as a solid lubricant when sliding conditions are relatively mild. The specific wear rate measured with the Sawin-type tester was low at low sliding velocities, but showed a sharp maximum at the high velocity region. The peak is lower for AlN hot-pressed at higher temperatures. The wear in this region is supposed to be caused by the small fractures at contact points. As a result, AlN ceramics with higher fracture toughness and hardness show higher wear-resistance. [Received July 10, 1985]

pp. 188–93

Mirror Finish Grinding of β-Sialon with Fine Grained Diamond Wheels

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The surface grinding tests for normal sintered β-sialon were carried out with various fine grained diamond wheels, and the influence of grain size on the characteristics of mirror finish grinding for the sintered sialon was investigated. When the sintered sialon was ground using fine grained wheels with a grain size of less than 6/12 μm, fine flow-type chips were formed. It has been confirmed that the formation of the chips and the removal of material proceed, in a large measure, by plastic deformation. In grinding the sintered sialon with fine grained wheels with a grain size of less than 6/12 μm, a mirror finished surface with a very small area of fractured surface could be obtained. For instance, when the sintered sialon was ground by a wheel with a grain size of 0.5/3 μm, a mirror finished surface with a surface roughness of about 0.03 μmR_{max} was obtained. The grinding force component, specific grinding energy U_e and maximum grinding wheel temperature θ_m increase with a decrease in grain size. When the mean grain diameter $\bar{d}$ does not exceed about 20 μm, U_e and θ_m are proportional to $(-\log \bar{d})$ approximately.

pp. 194–200

Grindability of Silicon Nitride Ceramics

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A hot pressed silicon nitride ceramic is very difficult to grind and it is expected to be widely applied to the heavy duty use, which does not permit the slightest machining damage. Therefore, the efficient grinding without machining damage is very necessary. In this study, the said ceramic