Elastic Properties of Engineering Ceramics at Elevated Temperature

Shuji SAKAGUCHI, Fumihiro WAKAI and Yosoo MATSUNO

(Government Industrial Research Institute, Nagoya
1-1, Hirate-cho, Kita-ku, Nagoya-shi 462)

Young's modulus and internal friction of engineering ceramics such as silicon nitride, silicon carbide and tetragonal zirconia polycrystals were measured by the resonance method up to 1400°C. Effect of hanging position on the apparent value of Young's modulus and internal friction was investigated. The apparent value of internal friction increased when the specimen is hung near the edge of the specimen because of the loss of vibration by the equipments. The error of apparent value of internal friction was negligibly small if the shift of hanging position from the node is less than 2.4% of the total length of the specimen. Measured value of Young's modulus was independent of hanging position. Internal friction increased abruptly above 1150°C in hot-pressed silicon nitride, above 1000°C in pressureless sintered silicon nitride and tetragonal zirconia polycrystals with increasing temperature. Internal friction showed peaks at 1080°C in hot-pressed silicon nitride, at 600°C in silicon carbide and at 180°C in tetragonal zirconia polycrystals. All of these temperatures corresponded to the temperatures at which Young's modulus decreased.

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Synthesis of Al_2TiO_5 Grain with Anisotropic Shape

Keiji DAIMON, Kazuhide TSUSAKA*, Toshiyasu YAMAUCHI and Etsuro KATO

(Nagoya Institute of Technology
Gokiso-cho, Showa-ku, Nagoya-shi 466
* Prefectural Seto Ceramic Senior High School)

Mixed powders of Al_2O_3 and TiO_2 were prepared by different processes using aluminum sulfate as a starting material of Al_2O_3 source. Aluminum titanate was synthesized by heating the mixtures in the presence of AlF_3. Rod-like grains of Al_2TiO_5 were produced by using mixed powder of γ-Al_2O_3 and anatase (TiO_2). Rod diameter and aspect ratio of Al_2TiO_5 grains depend on the preparation methods of raw materials. One of the best results, in which rod diameter and aspect ratio of the grains was about 5 μm and about 4, respectively, was obtained by heating the raw materials prepared by calcination of the coprecipitated hydroxides at 700°C, in the presence of 10% of AlF_3 at 1350°C. The elongated direction of the grain corresponded to a-axis (according to JCPDS card 26-40) of Al_2TiO_5 crystal. A sintered body of highly oriented Al_2TiO_5 crystals, in which Lotgering's index $F \parallel a$ was 0.88, was obtained owing to the anisotropic shape of the Al_2TiO_5 grains.

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Preparation of Lithium Tantalate Thin Films by Wet Process and Its Application to a Moisture-Sensitive Device

Fumio IMOTO, Tsutomu NANATAKI, Katsuyuki SHIOZAKI, Hitoshi IWAMOTO and Tatsuo YAMAMOTO*

(Faculty of Engineering, Shizuoka University
3-5-1, Johoku, Hamamatsu-shi 432
* Research Institute of Electronics, Shizuoka University)

Thin film of lithium tantalate was prepared by the dipping process from double alkoxide of the corresponding composition. SEM-observations and the X-ray diffraction analyses showed that the film consists of a pile of micro-particles (200-300 Å in diameter), and that the particles are amorphous when baked at 450°C or below and poly-crystalline when baked at 480°C or above. These two phases showed a marked difference in Raman spectra. The amorphous film showed ionic conductivity. Behavior of the amorphous film as a moisture-sensitive device was investigated. Surface ac-resistivity of an element (3.2×3.2 mm, 1 μm thick with a pair of comb-type electrodes) covered the range 10^7-10^4 Ω at the relative humidities of 25-90%. Reproducibility of the resistivity in the repeated cycles of the humidity was good, temperature-dependence was small and the response time to an abrupt change of humidity was sufficiently high. It was proved that the amorhous film is highly applicable.

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