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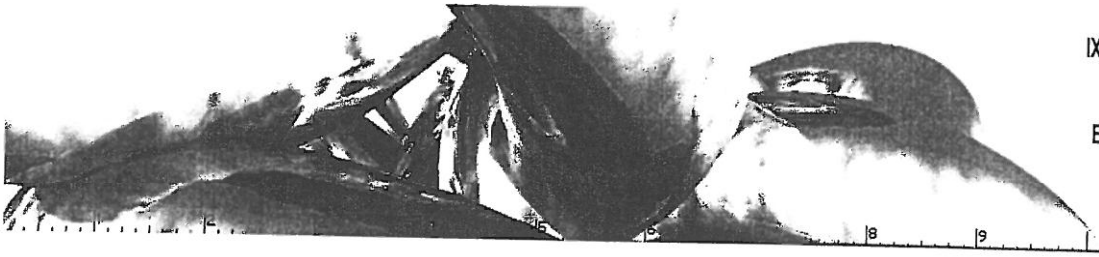

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Abstract Book

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nanopowder. The comparison of obtained data showed the better intensity of densification for PZT nanopowder among ceramic samples versus hard densification of BSCT nanopowder having maximal value of the critical pressure – extrapolated parameter of compaction curve at which the theoretical density is reached.

B-P-18 CAE Design and Manufacturing of a Ceramic Component by means of Cold Isostatic Pressing (CIP)

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The tecnique of pressing granulated powders is nowadays a near obliged choice to product ceramic components. The subsequent machinings on green compacted body are often critical and require a large waste of time. It is, therefore, comprehensible the necessity to obtain near net shape bodies just in the phase of pressing. The use of the CIP permits to minimize the density gradient characteristic of uniaxially pressing. Nevertheless, it doesn't allow to form components complying with the original shapes of the moulds. Such moulds, made of impermeable and flexible rubber, guarantee the separation between the ceramic powder and the fluid used to apply the pressure. They are subjected to an anisotropic buckling under the action of a load, and so they cause distortion of the proportions of the object obtained from the compaction of ceramic powder. Such phenomenon is the more emphasized the more complex is geometry of the component, and therefore of the rubber mould. In this paper an example of simulation of powder compaction process during isostatic pressing is described. This kind of simulation has been possible by means of MSC. Marc FEM code in which a specific visco-plastic model is implemented. The correct application of this instrument requires the knowledge of some characteristic parameters of the used ceramic material (a commercial alumina at 96%), whose determination has required the setting of two specific experimental methods (uniaxial and triaxial). Once known the parameters that describe with the best approximation the mechanical behaviour of the powder during the pressing process, it has been possible, by means of subsequent iterative analyses, to design the rubber mould in order to obtain, after pressing, a ceramic component with the expected shape.

B-P-19 Characteristics of orientated structure of particle packing in the green body prepared by the pressure slip casting

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The local orientated structure of particles is studied for alumina compact made by a pressured slip casting. Pressure slip casting is a forming method for the industrial production of ceramics with complex shape. The orientated structure of particle packing is origin for the cracking and anisotropic shrinkage during drying and sintering. We have studied the orientated structure in the green body prepared by the slip casting at normal pressure. The particles in the green body were aligned to the plaster mold and the degree of particle orientation was about 10-15%. The understanding on the packing structure is also very important for the pressure slip casting. Objective in this study is to characterize the orientated structure of particle packing in the green compact and the influence of orientated structure on the anisotropic shrinkage during sintering. The orientated structure is visualized and evaluated quantitatively using an optical method, which is based on the measurement of optical anisotropy using a polarized microscope. In the measurement, the compact is soaked in an immersion liquid to make it transparent, and is observed by a crossed polarized optical microscope to determine the retardation of the compact. The observation result shows that the orientated structure is developed in the green compact. The longitudinal axes of particles (a-axes) are oriented parallel to the surface of the plaster mold near the plaster mold/slurry interface. In other parts, the orientated direction of particles has a close relevance to the suction direction by plaster surface and casting direction of slurry. The degree of particle orientation is about 20% in all parts. Linear shrinkage during sintering is measured by the thermal measurement analysis. The shrinkage is the largest in the direction of the shortest axes of particles orientated in the green body.

B-P-20 Slip casting using wet-jet milled slurry

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Casting compact fabricated by slip casting using wet jet milled slurry, which had low viscosity and low re-flocculation property, had very high relative density and showed very small shrinkage during sintering. The square of the thickness of casting compact was proportional to casting time indicating slip casting was implemented well. The relative density of the calcined body prepared by wet jet milled slurry was very high. The relative density of the green bodies prepared by wet jet milled slurry was about 67% whereas the relative density of green bodies prepared by ball milled slurry was about 58%. Sintered bodies prepared by wet jet milled and ball milled slurry had similar relative density of 99%. The liner shrinkage of the sintered bodies prepared by wet jet milled and ball milled slurry was 11.5 and 16.8%, respectively

B-P-21 Fabrication of functionally graded SiAlON Ceramics by tape casting

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Functionally graded SiAlON ceramics (FG-SiAlONs) were successfully prepared by tape casting and lamination approach. Non-aqueous SiAlON slurries with five different a to b-SiAlON ratios, (85a:15b, 70a:30b, 55a:45b, 40a:60b and 25a:75b) were prepared by 66 MEK/34 EtOH (vol%) mixture. Crack free tapes with high flexibility and high green strength were prepared. The green tapes with a thickness of ~150μm were laminated to form ceramic parts as thick as 2.6mm. It has been found that the lamination pressure and cold isostatic pressing, after binder burnout step, are very critical parameters for a successful process. The lamination pressure should be

enough to provide an intimate contact between the layers while maintaining open pore channels for easy removal of organic substances. The cold isostatic pressing refurbishes defects, generated during the binder burnout and homogenizes the microstructure prior to sintering. Phase and microstructure analyses incorporation with hardness measurements clearly show that the FG-SiAlONs, prepared by tape casting, exhibit continuous and gradual change in composition and hardness. Thus, the tape casting approach is a viable method to produce FG-SiAlONs with precisely controlled composition, and subsequently properties, as a function of position. Accordingly, FG-SiAlONs with variety of microstructures can be designed by the tape casting approach, and tested for specific applications.

B-P-22 Generation of three-dimensional ceramic structures of preceramic polymers by laser radiation

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In this work a new method for rapid prototyping of ceramic bodies without layered structures and without material addition is presented. The material which is used, is a preceramic polymer, e.g. polysilazan. Thermal treatment at 120°C forms this liquid to a jelly-like solid body. In this solid material a focus point with two laser beams is generated, so that a polymerisation of the precursor occurs in the crossection of the laser beams. In this area the material is locally polymerized, but not sintered or pyrolized. The wavelength of the laser can be chosen in the transparent region of the precursor (400nm – 1450nm). The non-polymerized rest-material is separated in a solvent medium. At the end of this process a 3-dimensional preceramic body is created by laser treatment. This can be sintered now in a conventional furnace or by laser. The microstructure and the chemical composition of the polymerized and the sintered material are investigated and will be discussed.

B-P-23 Study of properties of YSZ films deposited by plasma spraying technique

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Yttria-stabilized zirconia (YSZ) powders (50 - 100mm in diameter) have been used to prepare plasma-sprayed thin ceramic films on the stainless steel sheets employing non-equilibrium plasma spray technology at atmospheric pressure. The dependency of microstructure of coatings on initial powder characteristics was investigated. Furthermore, effects of various plasma spray conditions on microstructure, crystallite size, phase content of the coatings have been evaluated. Plasma sprayed zirconium oxide films have been characterized using scanning electron microscope (SEM) and X-ray diffractometer (XRD) for study of microstructure and phase analysis as a part of a process optimization study. The deposit characteristics were compared with the processing parameters and revealed that they strongly depend on the in-flight particle parameters. The coating sprayed using finer powder displays better structural characteristics than the counterpart sprayed using coarse-grained powder feed. The density of the film increases with the spray temperature. The crystallite size of the film also exhibits a strong dependency on the spray conditions. It was demonstrated how the spray regime affects the thickness, density and porosity of the obtained films.

B-P-24 Model of convective membrane drying Al_2O_3 gel layers

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In the work the mathematical modeling of the convective membrane drying process of the alumina gel layers was carried. Drying is the limiting process for the preparation of ceramic bodies by the sol – gel route. The drying rate has a critical influence especially on the state of the surface of the dried gel layer. The membrane drying includes stages of heating and of constant and decreasing velocities of gel drying. The drying process is interpreted in terms of diffusion theory and diffusion coefficients are measured using the diffusion-couple method. Convective drying of the gel layer is considered to be combined process of heat transfer by conduction and a liquid transport by diffusion in a binary mixture of two incompressible constituents, i.e. gel particles and liquid. The numerical solution of mass balance equation for initial conditions describing the distribution of the initial concentration co throughout the mixture and for boundary conditions in the form of a surface flux across the gel-gas interface enables (for a previously established temperature dependence of the diffusion coefficient and from a knowledge of the convective velocity of the gel-air interface) an explicit calculation of the evolution of the liquid concentration profile in the gel with time and of the evolution of the mean concentration of liquid in the gel with time. The mathematical model of drying behavior of inorganic gels prepared from aqueous boehmite (γ-AlOOH) sols (20 wt% of boehmit in water, with HNO_3 addition for pH control) determined and experimentally verified. The expressed mathematical model of convective membrane drying of gel layers can be used for reliable estimating of effects which the environment temperature will have on gel-layer drying if the gel is saturated by liquid.

B-P-25 Processing methods for obtaining macro porous reticulated alumina structures

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Replicating polyurethane foam – method is widely known method of producing macro porous (300–500μm) reticulated and controlled ceramic structure. However, the strut cracks are quite typical defects of this processing method, and with the high porosity level is the main cause of a poor strength of the structure. Crack healing with multiple impregnations takes time and yet the porosity level remains relatively high. To increase the strength of the macro porous ceramic structure by reducing porosity level into ~50vol% and targeting for solid struts, two

F-P-79 Role of α-SiAlON nuclei addition on the rod-like Y-Sm α-SiAlON formation

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In this study, effect of seed addition on the microstructural development of Y-Sm α-SiAlON system has been investigated. Besides using pre-produced rod-like α-SiAlON seeds, growth in the glassy phase and harvested by chemical treatment, crunched Y-Sm/α-SiAlON was also used as nuclei. Microstructural results of both systems were compared with un-seeded samples. It was found that the crunched α-SiAlON addition has also caused the acicular resultant α-SiAlON grain formation, which indicates the dominant effect of thermodynamic stability on the on the preferential growth of α-SiAlON grains in the c direction.

F-P-81 Friction and wear of sinter - metallic brake pads for the brake system with C/C-SiC composite brake discs

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There has been a lot of interest recently in brake discs produced from carbon/carbon-silicon-carbide (C/C-SiC) composites for automotive and motorcycle brake applications. This composite material consists of a 2D C/C composite core and a hard SiC surface layer. It has excellent physical and chemical properties, including a low density (1.75 g/cm3), an extremely low wear rate and a high strength and thermal shock resistance. In order to take advantage of this material for brake discs, a novel brake system has been developed consisting of a floating fixture for the C/C-SiC brake disc on the hub, a specially redesigned brake calliper equipped with ceramic (zirconia-toughened mullite) pistons, and sinter-metallic brake pads. The new brake system is lighter than any conventional metallic system, besides it exhibits superior friction behavior and excellent braking performance. In this work we report on frictional and wear properties of sintered metallic brake linings in combination with the C/C-SiC brake disc. The influence of additives such are graphite, solid metallic sulphide lubricants, and abrasives in metallic matrix on the formation of the transfer layer has been investigated using scanning electron microscope (SEM) equipped with energy X-ray spectroscopy (EDX), and Auger electron spectroscopy (AES). The formation of the transfer layer mostly consisting of iron and copper oxides has been confirmed on the pad's worn surface. The frictional properties of the sinter-metallic brake pads were determined and related to composition and structure of the transfer layer.

F-P-82 Development of zirconia ceramics in ZrO_2-CeO_2-MgO system

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Zirconia ceramics were stabilised in ternary system by solid state reactions using 10 – 25 % of CeO_2 and 5-10 % MgO, respectivelly. All samples were thermally treated at 1550 - 1800°C in argon protective atmosphere and in oxidizing atmosphere also. Investigations of ceramic properties in conjunction with the phase compositions detected by X-ray Diffraction were performed. Microstructure by Scanning Electron Microscopy and surface morphology by Atomic Force Microscopy (AFM) were investigated. IR spectra analyses were performed on investigated compositions. The study oriented towards the ternary system ZrO_2 - CeO_2 - MgO is particularly interesting due to the novelty that brings to the specialty literature.

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CERTIFICATE

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