Preface

Several years ago, we have realized that existing opportunities in communication and networking of the international scientific community were no longer adequate and even insufficient. Given such a global vision, we could take decisions for ourselves and with a view to the needs of his own surroundings with reasonable certainty that they were compatible and effective in reaching objectives and valid values for oneself and at the same time in keeping with a shared own context that could eventually be globally extended and realized together. Therefore we have signed multilayer Agreement between Miskolc University, Tomsk State University and Institute of Strength Physics and Material Sciences SB RAS.

In accordance with a mutual wish to promote international scientific and technological exchange, Tomsk State University, Institute of Strength Physics and Material Sciences SB RAS and Miskolc University join in an agreement in order to further promote mutual cooperation in education and scientific research. Within fields that are mutually acceptable, the following general forms of cooperation were pursued: exchange of undergraduate and/or graduate students; exchange of faculty members and/or research scholars; joint research activities in nanomaterials, nanotechnology, living systems areas; exchange of scientific materials and information. The program was co-ordinated by Prof. Dr. S. Kulkov for TSU and ISPMS RAS for the Russian part and by Prof. Dr. L. Gömze for the Hungarian part.

The present issue of **építőanyag** – Journal of Silicate Based and Composite Materials, therefore, is a special issue that includes several papers on ceramic materials for different applications which were prepared by both Russian and Hungarian sides.

Several interesting topics were included in this issue.

Designing and developing highly-effective materials that remain stable under extreme conditions are among the primary tasks of modern materials science. One potential solution for this challenge lies in the development of composite materials with appropriate matrix and filler. The use of ceramics as matrix is reasonable as ceramics possess high mechanical strength, hardness and wear resistance while retaining their properties under high temperatures. However, ceramics are known to display low toughness making them brittle enough for specific applications. Therefore, the introduction of internal stresses at the filler/matrix interface allows strengthening of the overall composite structure. Such internal stresses can be introduced through a filler that has negative thermal expansion behavior due to the opposite thermal expansion values of the source filler and matrix materials.

A promising method for creating permeable ceramic materials with high porosity is the mixing large-fractured and ultrafine powders, and the geometry of the pores obtained in such a way is determined by the size and shape of large-fractured powder particles. Porous ceramic materials have been successfully used in various fields, including heat-insulating building materials, since they are durable, corrosion resistant and possess stable thermal features. The combination of these characteristics is especially important for construction in seismic regions.

Ceramics based on partially stabilized zirconium are the most interesting materials among the variety of ceramics due to their inherent high fracture toughness, as a result of their inherent transformational conversion. It is known that the characteristics are determined by the quality of the source ceramic powder (particle shape, particle size distribution), the conditions of compacting and sintering modes and any features that are presented in each phase, and how these phases, including pores, are arranged in relation to each other. The most important factor in the successful application of materials understands the features of a structure emerging in them on their behavior under mechanical impact.

It is well known that the porosity of brittle materials can have significant influence on their physical (mechanical, thermal, electrical) properties. Young's modulus, shear modulus and Poisson's ratio are essential parameters in the studies of advanced material mechanics. In addition, the macroscopic behavior of ceramics can vary from brittle to quasi-plastic, depending on the pore space volume. That is why the investigation of the evolution of deterioration in a brittle porous material at different levels of scale and the subsequent damage depending on the deformation rate, constraint, etc. is of considerable interest in terms of the emergence of a structural hierarchy of deformation and destruction in similar brittle materials (ceramics, natural stones etc.).

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