

Preface

The “Workshop on Engineering Ceramics” has had quite a long history. The first one was organized in October 1989 in the Smolenice Castle, Slovakia. At that time, just one month before the Fall of the Berlin Wall, the meeting was dedicated to building an acquaintance between scientists in the “west” and in the “east” who were doing similar research. No special technical topic was therefore selected for the first meeting. The next workshop was organized three years later in 1992. This meeting summarized the basic understanding of the processing, characterization and properties of engineering ceramics. The next meetings, held in 1996, 1999 and 2003, were each devoted to a particular “hot” technical topic. All of them were hosted by the Congress Centre of the Slovak Academy of Sciences in the Smolenice Castle. The three/four year intervals between the meetings seemed to be a good time span, allowing the participants to develop and present new ideas. Also the size of the meetings settled down to the optimum number of participants (from 50 to 60) giving the opportunity to avoid parallel sessions and to provide space for intensive discussions.

The NATO Science Committee sponsored Engineering Ceramics 1996, with the subtitle *Higher Reliability through Processing*. From this time the workshop adopted the title Advanced Research Workshop (ARW) which has remained until the present.

Engineering Ceramics 1999 took place at the time of the first disillusionment caused by the lower potential of engineering ceramics for application in industry than had been expected in the seventies and eighties. The topic of the workshop was *Multifunctional Properties—New Perspectives*. This workshop tried to define the new potential for engineered ceramics. One of the conclusions mentioned in the preface to the proceedings was that the discovery and understanding of other physical properties (low/high thermal conductivity, radiation penetration depth, electrical and magnetic properties) could lead to new applications.

The present special issue of the Journal of the European Ceramic Society covers the majority of the papers presented during the most recent workshop held from 11–15 May 2003 in the Smolenice Castle. fifty seven participants from 17 countries attended the advanced research workshop. The Integrated Centre for Advanced Materials and Molecular Science of the Institute of Inorganic Chemistry

of Slovak Academy of Sciences sponsored the workshop. The European Commission under the Contract No. G5MA-CT-2002-04051 financially supported the Centre.

The theme for the Advanced Research Workshop was: *Balance between Nano- and Macro-Structure Design*. The papers selected for the present issue cover the following topics:

- science of processing of engineered ceramic composites and their properties;
- synthesis of nano-powders;
- polymer derived nano-composites;
- nano/micro-composites prepared by powder routes;
- functionally graded materials;
- theoretical calculations of basic properties from first principles and nano-structural design through computer simulation.

During the last few years, the design of engineering ceramic materials, as of many other high-tech materials, has overcome the transition from a micro-structural to a nano-structural approach to their preparation. The most frequently mentioned benefit of this approach is a **new quality of material** as represented for example by high temperature super-plasticity; high mechanical performance (strength comparable to single-crystals, fracture behaviour approaching quasi-ductility, elevated reliability, improved high temperature properties); functional properties (high electrical conductivity, sensing, dielectric phenomena, elevated thermal conductivity, graded functions and properties of materials).

This development provided also the aim of the ARW, which was the discussion of the **importance of the nano-approach** and in particular the resolution of the conflict between the benefits obtained from the new properties and the difficulties accompanying the processing of the materials.

The selected articles published in the present issue of the Journal are seen as making a significant contribution to research on the nano-structural processing of advanced engineering ceramics.

Pavol Šajgalík, Ralf Riedel