



**Serbian Ceramic Society Conference
ADVANCED CERAMICS AND APPLICATION VI
New Frontiers in Multifunctional Material Science and Processing**

**Serbian Ceramic Society
Institute of Technical Sciences of SASA
Institute for Testing of Materials
Institute of Chemistry Technology and Metallurgy
Institute for Technology of Nuclear and Other Raw Mineral Materials**

PROGRAM AND THE BOOK OF ABSTRACTS

**Serbian Academy of Sciences and Arts, Knez Mihailova 35
Serbia, Belgrade, 18-20. September 2017.**

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Dear Colleagues,

We have great pleasure to welcome you to the Advanced Ceramic and Application Conference VI organized by the Serbian Ceramic Society in cooperation with the Institute for Testing of Materials, Institute of Technical Sciences of SASA, Institute of Chemistry Technology and Metallurgy and Institute for Technology of Nuclear and Other Raw Mineral Materials.

Advanced Ceramics today include many old-known ceramic materials produced through newly available processing techniques as well as broad range of the innovative compounds and composites, particularly with plastics and metals. Such developed new materials with improved performances already bring a new quality in the everyday life. The chosen Conference topics cover contributions from a fundamental theoretical research in advanced ceramics, computer-aided design and modeling of a new ceramics products, manufacturing of nanoceramic devices, developing of multifunctional ceramic processing routes, etc. Traditionally, ACA Conferences gather leading researchers, engineers, specialist, professors and PhD students trying to emphasize the key achievements which will enable the wide spread use of the advanced ceramics products in High-Tech industry, renewable energy utilization, environmental efficiency, security, space technology, cultural heritage, prosthesis, etc.

Serbian Ceramic Society has been initiated in 1995/1996 and fully registered in 1997 as Yugoslav Ceramic Society, being strongly supported by American Ceramic Society. Since 2009, it has continued as Serbian Ceramic Society in accordance to the Serbian law procedure. Serbian Ceramic Society is almost the only one Ceramic Society in the South-East Europe, with members from more than 20 Institutes and Universities, active in 16 sessions, by program and the frames which are defined by the American Ceramic Society activities.

For the first time Advanced Ceramic and Application Conference hosting delegations from Republics of Ghana, Nigeria, Niger and Cameroon with the idea to connect, share and provide positive influence to the scientific and industrial communities all around world.



Prof. Dr Vojislav Mitić
President of the Serbian Ceramic Society
World Academy Ceramics Member
European Academy of Sciences&Arts Member



Prof. Dr Olivera Milošević,
President of the General Assembly of the
Serbian Ceramic Society
Academy of Engineering Sciences of Serbia Member

Conference Topics

- Basic Science & Sintering of Ceramics
- Nano, Bio- & Opto Ceramic
- Electro & Multifunctional Ceramics
- Magnetic, Catalytic & Composite Materials
- Renewable Energy, Heritage & Archeology
- Industrial Talks

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these bands are less pronounced, which means that sample GI contains mostly unmodified carboxymethyl cellulose, although in the process of the preparation the least quantity of this organic compound as a modifier of the surface and adsorption characteristics of clay was used. SEM analysis of unmodified clay (5000× magnification) shows characteristic morphology of clay minerals, i.e. platelet particles of different sizes. SEM analysis of GI sample indicates lamellar particles with dominant fraction of 5-10 μm in diameter. Microphotographs of GII sample show polyhedral crystals, which are more evident on SEM analysis of GIII sample. We assumed these crystals originated from NaCl formed in the reactions of HCl and sodium from NaCMC.

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Analytical method for hysteresis modelling of magnetic materials applying labview software package

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This study presents the realization of a new analytical model for major and minor hysteresis loops of magnetic materials under LabVIEW software package.

In order to achieve better accuracy of the model, hysteresis loop was decomposed into two segments. Each of segments was modeled by the corresponding analytical expression. The advantage of the proposed model is small number of input parameters required to obtain a very well agreement between measured and modelled hysteresis loops. Therefore, this model is very comfortable for programming.

The LabVIEW realization was applied to simulate minor curves as well as major hysteresis curve of FeCo-2V alloy samples sintered in the range from 1300 °C to 1460 °C, 3.5 h in a protective atmosphere. Devices prepared from FeCo-2V alloy are usually exploited under extreme conditions. Therefore, magnetic measurements and appropriate modelling were performed in the operating frequency range from 5 Hz to 60 Hz. Common shapes as well as anomalous shapes of these dynamic loops were successfully modelled.

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Fractals and ceramics materials characterization

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Large part of powder based materials; especially ceramics are porous in more or less percentage. For such materials, two separated spaces are present. The “positive” space is made by grains or particles, while the “negative” space is “reserved” for pores. Formally speaking, the bulk of material space, V can be written as an union of “positive” and “negative” space which otherwise have no common points. Pores and grains share same

surfaces, and since grains have fractal nature, with fractal interior and fractal boundary surfaces, the pores also have fractal “walls”. This implies two conclusions: the pores should be treated as the *fractal* objects, i.e., the objects having non-fractal interior, and fractal surface with dimension equal to grain’s fractal dimension. Suppose that the morphology of materials changes through time for the consideration process. By box counting methods fractal dimension definition, it follows that three sintering phase formulae based on the union described above, the sintering initial phase, the Frenkel formula takes corrected form including fractal dimension value.

In this paper we applied four methods: Cube counting, Triangulation, Variance and Power spectrum method. All of these are very important and quite a different then the other, Ceramic Characterization Classic methods, what is opening new frontiers in material science characterization.

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Ceramics in modern concept of national security

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Recent decades have brought new threats a change in national security concerns. Their emergence imposed a need for new approaches in terms of adequate new tools and methods to detect, identify, and neutralise them and also to provide the performance of the existing components of national security system. The effective management and handling requires new tools and methods to be smaller, highly integrated and ever more complex (National Materials Advisory Board, 1999: 35-36). Today, the use of ceramics appears to be critical for these tasks.

Characteristics such as light weight, low density, hardness, undetectability on metal detectors make ceramics suitable for terrorist and surprise tactics. A ceramic layer in the body armour is, theoretically, supposed to break up the bullet and a composite layer of fabrics, to catch the bullet (Bengisu, 2001: 415). Its light weight makes it easy to wear and carry. A ceramic knife, most often made of zirconium dioxide, is very hard and tough (Danzer et al., 2013: 614), thus suitable for serious attacks.

Ceramic projectiles with coat of light metal disintegrate into particles upon impacting a target which minimises their penetration capacity. Thus, they are not yet suitable for combat bullets, but are suitable for crowd control. But, experiments indicate that composite ceramic bullet can damage soft tissue after travelling over a 100 yards (Brogdon; Messmer, 2011: 216-217), and even ceramic targets (Yi et al., 2017: 298). What makes them a security risk is that they are untraceable.

As far as firearms are concerned, the US Undetectable Firearms Act of 1988 makes it illegal to manufacture, import, sell, ship, deliver, possess, transfer, or receive any firearm that is not as detectable by walk-through metal detection as a security exemplar containing 105 g of steel, or any firearm with major components that do not generate an accurate image before standard airport imaging technology.

From the aspect of requirements for contemporary national security concepts, ceramics, generally, offer at least three strategic comparative advantages: much lower density than the super alloys, operate uncooled at extreme temperatures and higher resistance to wear