Serbian Ceramic Society Conference
ADVANCED CERAMICS AND APPLICATION VIII
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, 23-25. September 2019.

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Book title: Serbian Ceramic Society Conference - ADVANCED CERAMICS AND APPLICATION VIII Program and the Book of Abstracts

Publisher:
Serbian Ceramic Society

Editors:
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Technical Editors:
Dr Ivana Dinić
Dr Marina Vuković

Printing:
Serbian Ceramic Society, Belgrade, 2019

Edition:
100 copies

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

666.3/.7(048)
66.017/.018(048)

SRPSKO keramičko društvo. Conference Advanced Ceramics and Application : New Frontiers in Multifunctional Material Science and Processing (8 ; 2019 ; Beograd)
Program ; and the Book of abstracts / Serbian Ceramic Society Conference Advanced Ceramics and Application VIII : New Frontiers in Multifunctional Material Science and Processing, Serbia, Belgrade, 23-25. September 2019. ; [organized by] Serbian Ceramic Society ... [etc.] ; [editors Vojislav Mitić, Lidija Mančić, Nina Obradović]. - Belgrade : Serbian Ceramic Society, 2019 (Belgrade : Serbian Ceramic Society). - 98 str. : ilustr. ; 30 cm

Tiraž 100.

ISBN 978-86-915627-7-9

а) Керамика -- Апстракти б) Наука о материјалима -- Апстракти в) Наноматеријали -- Апстракти

COBISS.SR-ID 279041804

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Electronics ceramics grain boundaries and complex fractal dimension

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Analysis of ceramic grain boundaries, esspecially for $BaTiO_3$, is also important for its dielectric and conductive properties. In this regard, the fractal analysis was highlighted. The grain contacts geometry based on intergranular contact surface fractal morphology was the subject of our long term research. A new approach based on complex dimension fractal geometry and correlation between microstructure-nanostructure and rare-earth properties and other additives doped $BaTiO_3$-ceramics and electronics properties, is applied . In addition to the continuous type of scaling typical for real standard fractal objects, complex objects are considered here, which also have a discrete scaling symmetry with logarithmic space period. That rely on their appearance on the various , micro and macro, electrical and other properties of $BaTiO_3$-ceramics.

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Complex fractal dimension and possible application in electronic ceramics

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Considering the extremely growing exigency for further miniaturization and a higher level of packaging of electronic circuits and components, this paper is aimed at developing a more sophisticated application of fractals. In this sense, the progress in the development of the mathematical-physical tool in further upgrading of fractal microelectronics is presented here. Barium titanate samples with bayi yttrium samples are used as the experimental basis under conditions of using the highest levels of nanotechnology, especially grain deposition. In this regard, the ideas of complex fractal analysis will be elaborated in this paper. Examples of complex fractal dimensions are known in the literature. The relationship between fBm (Fractional Brown motion) and Bm is given by the left-sided Riemann-Liuville fractional integral

$$B_H(t) = \frac{1}{\Gamma(H+0.5)} \int_a^t dB(t') \cdot (t-t')^{H-0.5}.$$

When is H=0.5, in the above equation, fBm and Bm is matching.For H >0.5 the process is positive, and for H <0.5 negatively correlated. It shows that the imaginary part of the fractal dimension is translated into log-periodic modulation, which completes the behavior by leading a degree law, and is based on discrete fractal symmetry.

In particular, complex Brownian motion can be generated based on 1d complex Brownian motion in matlab code. There is also a corresponding fractional calculus of complex order. Other parallels with electrical processes in $BatiO_3$ ceramics are also possible.