



#### IV.O.14

### INDUCED SUPERHYDROPHOBIC AND ANTIMICROBIAL CHARACTER OF ZINC METAL MODIFIED CERAMIC WALL TILE SURFACES

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**Keywords:** Superhydrophobic ceramic tile surface, contact angle, antimicrobial surface, antimicrobial characterization, ceramic tile glaze

**Abstract:** Hydrophobic surfaces are also known to have antimicrobial effect by restricting the adherence of microorganisms on the surface. However, ceramic products are produced by high temperature processes resulting in a hydrophilic surface. In this study, an industrial ceramic wall tile glaze composition was modified by the inclusion of metallic zinc powder in the glaze suspension applied on the pre-sintered wall tile bodies with air spray gun. The glazed tiles were fired at peak temperatures ranging from 980°C to 1100°C for 5 and 30 minutes. The fired tile surfaces were coated with a commercial composition of 10% fluoropolymer, 60% alkoxy silane and 30% ethanol (ECC-4000) in order to avoid water absorption, and enhance the hydrophobic character. The surface hydrophobicity and the antimicrobial activity results were compared with that of unmodified uncoated gloss fired wall tiles. The surfaces were examined with SEM, XRD and the water contact angles were measured with a goniometer. The antimicrobial activity tests of the surfaces were conducted according to ASTM E2180-07 (Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent in Polymeric or Hydrophobic Materials).

For the tiles fired at 1000°C for 5 min, the surface contact angle of <math><30^\circ</math> of the unmodified, uncoated wall tile changed to Staphylococcus aureus of the unmodified but coated surface increased 15.5 folds while of the Zn modified and coated surface decreased by 99.68%, and with *Pseudomonas aeruginosa* of the unmodified but coated surface increased 1.17 folds while of the Zn modified and coated surface decreased by 86.7% as compared to the unmodified, uncoated surfaces. The increase of the hydrophobicity and the decrease in the antimicrobial activity of the Zn metal powder modified glaze compositions were attributed to the formation of willemite (





# raMat 2017

10TH INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE & ENGINEERING

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8 – 11 March 2017

Coordinated by:

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## BOOK OF ABSTRACTS



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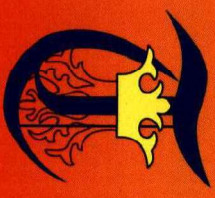
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## CONTENT

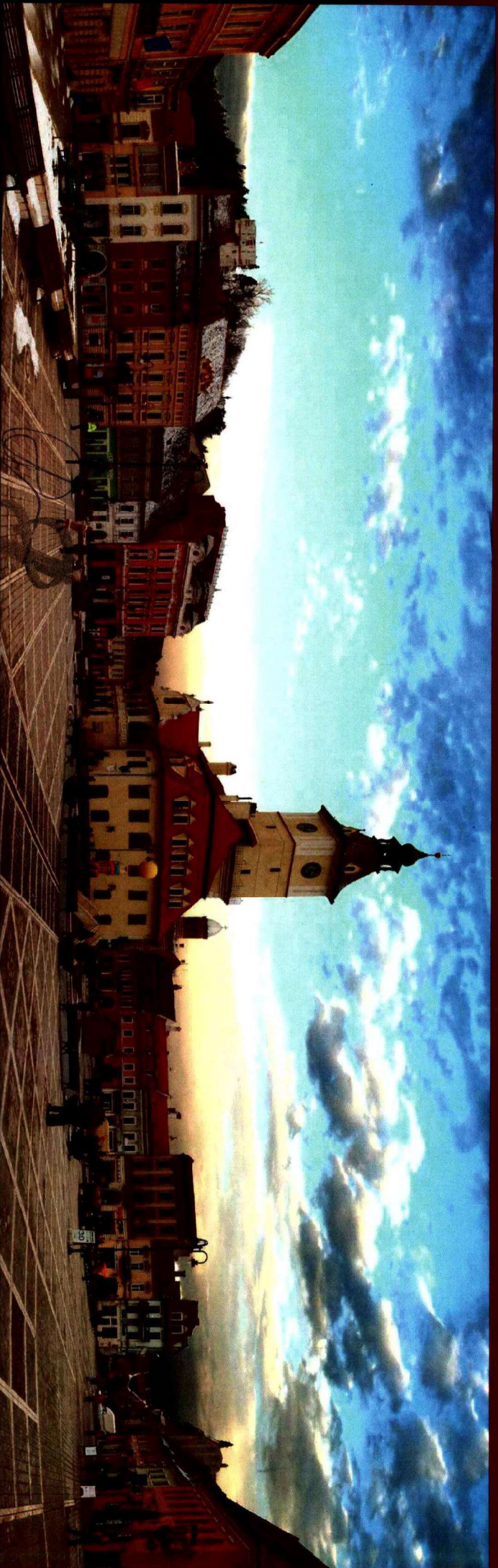
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# CERTIFICATE OF PARTICIPATION

First Name, Surname Nurcan Calis Acikbas

Organization, Country Bilecik Seyh Edeballi University, Turkey









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10TH INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE & ENGINEERING

Braşov - ROMANIA

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## Hall C

### 12.10: Oral Presentations IIb (Section II)

Chairpersons: **Iulian ANTONIAC**, University Politehnica of Bucharest, Romania  
**Camelia GABOR**, Transilvania University of Brasov, Romania

#### 12.10: II.O.1. Induced wettability and surface-volume correlation of composition for bovine bone derived hydroxyapatite particles

A. MAIDANIUC, S.I. VOICU, M. MICULESCU, A.C. MOCANU, I. PENCEA, C. ANDRONESCU, E. MATEI, I. CSAKI, Politehnica University of Bucharest, ROMANIA  
T. MACHEDON-PISU, Transilvania University of Brasov, ROMANIA

#### 12.25: II.O.2. Effect of sintering temperature on structure and properties of some new hydroxyapatite based composites for bone tissue engineering

C. TECU, L. DRAGOMIR, C. MILEA, A. ANTONIAC, I. ANTONIAC, University Politehnica of Bucharest, ROMANIA  
M.G. GOK, G. GOLLER, Istanbul Technical University, TURKEY

#### 12.40: II.O.3. Morphology and biocompatibility characterization of nanostructured TiO<sub>2</sub> surfaces for biomedical implants developed by electrochemical anodization

G. STRNAD, S. MOICA, Petru Maior University of Tirgu Mures, ROMANIA  
D. PORTAN, University of Patras, GREECE  
L. JAKAB-FARKAS, Sapientia University of Cluj Napoca, ROMANIA  
C. PETROVAN, O. RUSSU, D. R. MANU, University of Medicine and Pharmacy, Tirgu Mures, ROMANIA

#### 12.55: II.O.4. Corrosion behavior of biodegradable FeMnSi-MgCa alloy

F. SĂNDULACHE, S. STANCIU, R. CIMPOEȘU, B. ISTRATE, N. CIMPOEȘU, Gheorghe Asachi Technical University of Iasi, ROMANIA  
C. TRINĂ, G. ZEGAN, "Ion Ionescu de la Brad" University of Agricultural Sciences and Veterinary Medicine, ROMANIA

#### 13.10: II.O.5. Resveratrol covalent immobilization onto cellulose acetate membranes for improved osseointegration

S.I. VOICU, M.A. PANDELE, A. IORDACHE, F. MICULESCU, University Politehnica from Bucharest, ROMANIA  
A.I. STARAS, P. NEACUSU, A. CIMPEAN, University of Bucharest, ROMANIA  
V.K. THAKUR, University of Cranfield, School of Aerospace, Transport and Manufacturing, UNITED KINGDOM

## Hall D

### 11.30: Oral Presentations IIc (Section III)

Chairpersons: **Rodica Mariana ION**, ICECHIM, Bucharest; Valahia University of Targoviste, ROMANIA  
**Cătălin CROITORU**, Transilvania University of Braşov, ROMANIA

#### 11.30: III.O.5. Eco efficient melting of ceramic frits

A. LÓPEZ-DELGADO, J.I. ROBLA, I. PADILLA, J. GARCÍA-HIERRO, National Centre for Metallurgical Research, Madrid, SPAIN  
M. ROMERO, Eduardo Torroja Institute for Construction Sciences, Madrid, SPAIN

#### 11.45: III.O.6. Soft magnetic composites based on hybrid coated Fe-Si nanocrystalline powders

B.V. NEAMTU, Technical University of Cluj-Napoca, ROMANIA  
M. NASUI, Center for Superconductivity, Spintronics and Surface Science, Technical University of Cluj-Napoca, ROMANIA  
T.F. MARINCA, F. POPA, I. CHICINAȘ, Technical University of Cluj-Napoca, ROMANIA

#### 12.00: III.O.7. Characterization of thermoplastic bearings by using of horizontal rotational forming

P.A. POP, University of Oradea, ROMANIA  
J. LOPEZ-MARTINEZ, Univesitat Politècnica de València, Alcoy-Alicante, SPAIN  
I.M. GORDAN, University of Oradea, ROMANIA  
S. FERRANDIZ-BOU, Univesitat Politècnica de València, Alcoy-Alicante, SPAIN  
L.G. MITU, Transilvania University of Brasov, ROMANIA

**12.55: V.O.4. Properties analysis of dextrane magnetic carrier compounds with potential applications in environmental and biomedical fields**

A.M. PREDESCU, E. MATEI, A.C. BERBECARU, M.C. PANTILIMON, C.I. DRĂGAN, C. PREDESCU, C. GRĂDINARU,  
University Politehnica of Bucharest, ROMANIA

**13.10: V.O.5. Carbon coated metallurgical grade silicon decorated graphene anodes**

G. HATIPOĞLU, *Sakarya University, Engineering Faculty, Dept. of Metallurgy and Materials Engineering and Tubitak, Marmara Research Center, Energy Institute, TURKEY*

M. ALAF, *Bilecik Seyh Edebali University, Engineering Faculty, Dept. of Metallurgy and Materials Engineering, Gulumbe Campus, TURKEY*

D. UZUN, *Tubitak, Marmara Research Center, Energy Institute, TURKEY*

H. AKBULUT, *Sakarya University, Engineering Faculty, Dept. of Metallurgy and Materials Engineering, Esentepe Campus, TURKEY*

**13.30: Lunch**

**Hall B**

**15.00: Oral Presentations IIIa (Section I)**

*Chairpersons: Horia ALEXANDRU, Politehnica University of Bucharest, ROMANIA*

*Traian Lucian SEVERIN, "Stefan cel Mare" University of Suceava, ROMANIA*

**15.00: I.O.12. Effect of pre-straining and baking temperature on bake hardening behaviour of hot-dip galvanized steels**

G. AYATAN, Y. YUREKTURK, *Istanbul Technical University, Metallurgical and Materials Department, Istanbul, TURKEY*

M. BAYDOGAN, *Istanbul Technical University, Metallurgical and Materials Department, Istanbul, TURKEY*  
*Istanbul Technical University, Prof. Dr. Adnan Tekin Material Sciences and Production Technologies Applied Research Center, Istanbul, TURKEY*

**15.15: I.O.13. Estimating volume fractions of microstructural constituents in austempered high silicon alloyed GJS 600-10 ductile iron through magnetic measurements (VSM)**

Y. YUREKTURK, *Istanbul Technical University, Metallurgical and Materials Department, Istanbul, TURKEY*

M. BAYDOGAN, *Istanbul Technical University, Metallurgical and Materials Department, Istanbul, TURKEY*  
*Istanbul Technical University, Prof. Dr. Adnan Tekin Material Sciences and Production Technologies Applied Research Center, Istanbul, TURKEY*

**15.30: I.O.14. Oxide nanomaterials: synthesis, mechanistic studies and technological innovation in wastewater treatment by flotation**

C. COVALIU, G. PARASCHIV, *University Politehnica of Bucharest, ROMANIA*

C. MOGA, *S.C. DFR Systems S.R.L., Bucharest, ROMANIA*

M. MATACHE, *National Institute of Research-Development for Machines and Installations Designed to Agriculture and Food Industry, Bucharest, ROMANIA*

**15.45: I.O.15. Formation of Al-Ti based phases for grain refinement of Al alloys produced by high energy ball milling**

M. ARIKOĞLU, A. ÖZER, *Cumhuriyet University Metallurgical and Materials Engineering Department, Sivas, TURKEY*

**16.00: I.O.16. Identification of the creep models parameters of the metallic materials using evolutionary algorithms**

B. DELIKTAS, H.T. TÜRKER, *Uludag University, Civil Engineering Department, Bursa, TURKEY*

M. SÖNMEZ, *Aksaray University, Civil Engineering Department, Bursa, TURKEY*

A. DURMUS, *Uludag University, Civil Engineering Department, Bursa, TURKEY*

**16.15: I.O.17. Analytical description of the bainite transformation kinetics in steels 300m and D6AC**

A.A. KUKLINA, M.V. MAYSURADZE, Y.V. YDIN, *Ural Federal University named after the first President of Russia B.N. Yeltsin, Ekaterinburg, RUSSIA*

**16.30: I.O.18. Concepts regarding the heat transfer and reduction of the energy consumptions at the metallurgical heating furnaces**

*D. CONSTANTINESCU, B.A. CĂRLAN*, University Politehnica of Bucharest, ROMANIA

**Hall D**

**15.00: Oral Presentations IIIb (Section III)**

*Chairpersons: Ionel CHICINAȘ*, Technical University of Cluj-Napoca, ROMANIA  
*Liana Sanda BALTES*, Transilvania University of Brașov, ROMANIA

**15.00: III.O.13. Theoretical comparison between carbon fiber and graphene composites for automotive components**

*L. RAD, M. ADAM, A. CHIRU*, Transilvania University of Brasov, ROMANIA

**15.15: III.O.14. Life cycle cost comparison between steel, carbon fiber composites and graphene composites**

*L. RAD, M. ADAM, A. CHIRU*, Transilvania University of Brasov, ROMANIA

**15.30: III.O.15. Nanoparticle embedded mixed matrix PSF membranes characterization and membrane performance**

*S.C. PINTILIE, L.G. TIRON, A.L. LAZAR, S. BALTA*, Dunarea de Jos University of Galati, ROMANIA

**15.45: III.O.16. Optimal composition of mixed material for the thermoforming process**

*A. SONSIRI, P. PALICAMIN*, Rajamangala University of Technology Krungthep, Bangkok, THAILAND

**16.00: III.O.17. Effect of sequential milling (mechanical alloying-cryogenic milling) on the microstructural and mechanical properties of TiB<sub>2</sub> reinforced Al-12.6 wt.% Si MMCs**

*E. TEKOĞLU, S. MERTDİNÇ, D. AĞAOĞULLARI, M. L. ÖVEÇOĞLU*, Istanbul Technical University, TURKEY

**16.15: III.O.18. Analysis of flexural properties for metal/plastic composites made by a new hybrid process**

*J. BUTT, H. SHIRVANI, S. NAMMI*, Anglia Ruskin University, Department of Engineering & Built Environment, Chelmsford, Essex, UNITED KINGDOM

**Hall E**

**15.00: Oral Presentations IIIc (Section IV)**

*Chairpersons: Corneliu MUNTEANU*, Technical University of Iasi, ROMANIA  
*Elena Manuela STANCIU*, Transilvania University of Brasov, ROMANIA

**15.00: IV.O.13. Effect of process parameters on the tribological properties of porcelain waste reinforced epoxy composites**

*N. ÇALIŞ AÇIKBAŞ*, Bilecik Seyh Edebali University, Engineering Faculty, Dept. of Metallurgy and Materials Engineering, Bilecik, TURKEY

*B. YAMAN*, Eskisehir Osmangazi University, Engineering Faculty, Dept. of Metallurgy and Materials Engineering, Eskisehir, TURKEY

*G. AÇIKBAŞ*, Bilecik Seyh Edebali University, Vocational School, Metallurgy Program, Bilecik, TURKEY

**15.15: IV.O.14. Induced superhydrophobic and antimicrobial character of zinc metal modified ceramic wall tile surfaces**

*S. ÖZCAN*, Bilecik Seyh Edebali University, Engineering Faculty, Dept. of Chemical and Process Engineering, Bilecik, TURKEY

*G. AÇIKBAŞ*, Bilecik Seyh Edebali University, Vocational School, Metallurgy Program, Bilecik, TURKEY

*N. ÇALIŞ AÇIKBAŞ*, Bilecik Seyh Edebali University, Engineering Faculty, Dept. of Metallurgy and Materials Engineering, Bilecik, TURKEY

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