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EUROMAT 2017

HELLENIC METALLURGICAL SOCIETY (HMS)

HELLENIC SOCIETY FOR THE SCIENCE & TECHNOLOGY OF CONDENSED MATTER (HSSTCM)

TIME: 13:00-15:00 | ROOM: FOYER, E1/M1

P1

Tuesday, September 19, 2017

Symposium B.5: Advanced Ceramics

B5-P-TUE-P1-12	**PHOTOCATALYTIC ACTIVITY OF CLAY CERAMIC COATED WITH TITANIA AND ZnO NANOPARTICLES** **Dr.hab.sc.ing. Visvaldis Svinka**[1], Dr.sc.ing. Ruta Svinka[1], Mg.sc. Oskars Lescinskis[1] *[1]Riga Technical University Institute Of Silicate Naterials, Riga, Latvia*
B5-P-TUE-P1-13	**TOUGHENING OF Nb2O5 DOPED ZIRCONIA BIOMATERIAL FABRICATED BY MICROWAVE SINTERING TECHNOLOGY** Dr Amparo Borrell[1], Dr Maria Dolores Salvador[1], PhD Lorena Gil[1], Dr Felipe L. Peñaranda2, **PhD Eugeni Cañas**[4], Dr Carlos F. Gutierrez[3] *[1]Institute of Materials Technology, Universitat Politècnica De València, Valencia, Spain, [2]Instituto de Aplicaciones de las Tecnologías de la Información y de las Comunicaciones Avanzadas (ITACA), Universitat Politècnica de València, Valencia, Spain, [3]Centro de Investigación en Nanomateriales y Nanotecnología (CINN) [Consejo Superior de Investigaciones Científicas (CSIC), Universidad de Oviedo, Principado de Asturias]. , El Entrego, Spain, 4Instituto de Tecnología Cerámica (ITC), Universitat Jaume I, Castellón, Spain*
B5-P-TUE-P1-14	**DEVELOPMENT AND PROPERTIES OF NANOCOMPOSITE Al2O3-NiAl2O4 BY REACTIVE SINTERING** **Phd student Fotini Petrakli**[1], Prof Athena Tsetsekou[1] *[1]School of Mining and Metallurgical Engineering, National Technical University of Athens, Athens, Greece*
B5-P-TUE-P1-15	**MAGNETORESISTANCE OF THE HIGH-PRESSURE PEROVSKITE-LIKE PHASES Gd0.7Cu3V4O12 AND Er0,73Cu3V4O12 AT PRESSURES UP TO 50 GPa** **Irina Ustinova**[1], Nina Melnikova[1], Nadezhda Kadyrova[2], Alexander Tebenkov[1], Alexey Babushkin[1] *[1]Ural Federal University, Ekaterinburg, Russian Federation, [2]ISSC UB RAS, Ekaterinburg, Russian Federation*
B5-P-TUE-P1-16	**THERMAL BEHAVIOR OF LOCAL STRUCTURE IN LITHIUM PEROXIDE Li2O2** **Dr. Yoshitaka Matsushita**[1], Dr. Motoharu Imai[1], Dr. Masashi Miyakawa[1], Dr. Satoshi Kawada[1] *[1]NIMS, Tsukuba, Japan*
B5-P-TUE-P1-17	**INFLUENCE OF THE ZrSiO4 AND ZnO ON THE WHITENESS AND PHYSICAL-MECHANICAL PROPERTIES OF INDUSTRIAL CERAMIC SANITARY-WARE** **Boudeghdegh Kamel**[1] *[1]LEAM, Faculty of Sciences and Technology, University Mohammed Seddik ben Yahia- JijelUniversity of Jijel, Jijel, Algeria*
B5-P-TUE-P1-18	**DESIGN OF NOVEL MATERIALS BASED ON ORTHOPHOSPHATES WITH CONTROLLABLE THERMAL EXPANSION** **Dr., Ass. Professor Vladimir Pet'kov**[1], Dr., Ass. Professor Elena Asabina, postgraduate Alexander Shipilov, postgraduate Anton Dmitrienko, postgraduate Artemy Alekseev, postgraduate Dmitriy Lavrenov, Dr. Igor Schelokov *[1]Lobachevsky State University of Nizhni Novgorod, Nizhni Novgorod, Russian Federation*
B5-P-TUE-P1-19	**MICROSTRUCTURE OF EUROPIUM NIOBATE AND TANTALATE THIN FILMS PREPARED BY SOL-GEL METHOD** **PhD. Helena Brunckova**[1], PhD. Lubomir Medvecky[1], PhD. Erika Mudra[1], PhD. Alexandra Kovalcikova[1], PhD. Juraj Durisin[1], PhD. Martin Sebek[1] *[1]Institute of Materials Research Slovak Academy of Sciences, Kosice, Slovakia*
B5-P-TUE-P1-20	**TWO STEP SINTERING ROUTE FOR ALUMINA-BASED CERAMICS** **Maksim Boldin**[1], Aleksander Popov[1], Eugene Lantsev[1], Aleksey Nokhrin[1], Vladimir Chuvil'deev[1] *[1]Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod, Russian Federation*
B5-P-TUE-P1-22	**INFLUENCE OF THE REDUCED GRAPHENE OXIDE (rGO) ON THE MICROSTRUCTURE AND PROPERTIES OF THE CERAMICS ZrO2-Y2O3** postgraduate Artyom Glukharev[1], Sc.D. Vladimir Konakov[1], **Ph.D. Olga Kurapova**[1], student Valeria Lebedeva[1], postgraduate Evgeny Boltynyuk[1] *[1]Saint-Petersburg State University, Saint-Petersburg, Russian Federation*

B5-P-TUE-P1-8 Properties and structure of binary and ternary tellurite glasses

Mrs. NagiaS. Tagiara[1], Mrs. Elham Moayedi[2], Prof. Apostolos Kyritsis[3], Prof. Lothar Wondraczek[2], Dr. EfstratiosI. Kamitsos[1]
[1]Theoretical and Physical Chemistry Institute, National Hellenic Research Foundation, Athens, Greece, [2]Otto Schott Institute of Materials Research, University of Jena, Jena, Germany, [3]National Technical University of Athens, Zografou Campus, Athens, Greece

B5-P-TUE-P1-9 Analysis of the electronic conductivity of thick-film Gd-doped ceria by Hebb-Wagner polarization method

Jong Hoon Joo[1], Gyeong Duk Nam[1], Young-jin Ryu[1], Jeong Hwan Park[1], Sin Myung Kang[1]
[1]Chungbuk National University, Cheongju, South Korea

B5-P-TUE-P1-10 Solid solutions of MAX phases obtained by SHS synthesis

M.Sc. Paulina Borowiak[1], M.Sc. Katarzyna Chabior, D.Sc. Leszek Chlubny, D.Sc. Dariusz Zientara, Prof. Jerzy Lis, Prof. Mirosław Bućko
[1]University of Science and Technology, Kraków, Poland

B5-P-TUE-P1-11 Tape Casting Fabrication of Metal silicides reinforced with graphene

Dr. Dreidy Mercedes Vasquez Sandoval[1], Undergraduate Jahaziel Toro Carrasco[1], Dr. Ramalinga Mangalaraja[2], Dr. Jaime Morales[1]
[1]Escuela de Ingeniería Química, Pontificia Universidad Católica de Valparaíso, Av. Brasil 2950, Valparaíso, Chile, Valparaiso, Chile, [2]Escuela de Ingeniería Química, Pontificia Universidad Católica de Valparaíso, Av. Brasil 2950, Valparaíso, Chile, Valparaiso, Chile, [3]Advanced Ceramics and Nanotechnology Laboratory, Department of Materials Engineering, Faculty of Engineering, University of Concepcion, Concepcion 407-0409, Chile, Concepción, Chile, [4]Escuela de Ingeniería Química, Pontificia Universidad Católica de Valparaíso, Av. Brasil 2950, Valparaíso, Chile, Valparaiso, Chile

B5-P-TUE-P1-12 Photocatalytic activity of clay ceramic coated with titania and ZnO nanoparticles

Dr.hab.sc.ing. Visvaldis Svinka[1], Dr.sc.ing. Ruta Svinka[1], Mg.sc. Oskars Lescinskis[1]
[1]Riga Technical University Institute Of Silicate Naterials, Riga, Latvia

B5-P-TUE-P1-13 Toughening of Nb2O5 doped zirconia biomaterial fabricated by microwave sintering technology

Dr Amparo Borrell[1], Dr Maria Dolores Salvador[1], PhD Lorena Gil[1], Dr Felipe L. Peñaranda[2], PhD Eugeni Cañas[4], Dr Carlos F. Gutierrez[3]
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B5-P-TUE-P1-13

Toughening of Nb2O5 doped zirconia biomaterial fabricated by microwave sintering technology

Dr Amparo Borrell[1], Dr Maria Dolores Salvador[1], PhD Lorena Gil[1], Dr Felipe L. Peñaranda[2], PhD Eugeni Cañas[4], Dr Carlos F. Gutierrez[3]

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The aim of this research is to investigate the characteristics and mechanical properties of Nb2O5 doped zirconia. Samples of partially stabilized-zirconia (3Y-TZP) with Nb2O5 in amounts of 0.15-1.5 mol.% were prepared by sol–gel technique and sintered by non-conventional microwave process.

The powders of each composition were cold isostatic pressed and then sintered at 1200 °C by microwave and 1300 and 1400 ºC by conventional sintering. The phase constitution and microstructures of the as-sintered ceramic composites were characterized by using an X-ray diffractometer and a scanning electron microscope respectively.

The mechanical properties of the ceramic composites were evaluated through Vickers hardness, Young modulus and fracture toughness tests. It was found that increasing the Nb2O5 concentration had a strong effect on the densification behavior, microstructure and mechanical properties of the composites.

The Vickers hardness of ZrO2 doped ceramics obtained by microwave sintering increases with the increase in the Nb2O5 content due to the formation of Nb2Zr2O17 phase and the higher densification of the bodies. The maximum Vickers hardness of ZrO2/0.25 mol.% Nb2O5 bodies fabricated by microwave sintering (15.8 GPa) was 20% higher than that of pure ZrO2 (13.2 GPa).

This work has been supported by the Spanish Ministry of Economy and Competitiveness MINECO by MAT2015-67586-C3-R project and Juan de la Cierva-Incorporacion contract (IJCI-2014-19839), and the Generalitat Valenciana by the Santiago Grisolía scholarship (GRISOLIA/2013/035) and PROMETEO/2016/040 project.

Toughening of Nb_2O_5 doped zirconia biomaterial fabricated by microwave sintering technology

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Introduction

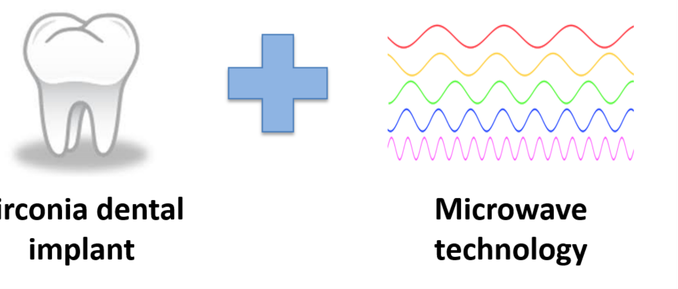
Statistics provided by the American Association of Oral and Maxillofacial Surgeons show that 69% of adults ages 35 to 44 have lost at least one permanent tooth to an accident, gum disease, a failed root canal or tooth decay. Furthermore, by age 74, 26% of adults have lost all of their permanent teeth [1]. Most of these patients benefit greatly from dental implants and the use of biomaterials is becoming increasingly necessary. Therefore, it is required to study the wide possibilities of advanced ceramic materials for dental applications, since they are more resistant to corrosion and wear than metallic materials.

The convencional method for ceramic sintering require a energy-intensive process at high temperatures (>1200°C), leading to large energy and production costs. An atractive and novel alternative to the convencional sintering is the microwave technology, with which dense ceramics can be obtained in less time and lower temperature, thus reducing expenses and environmental impact [2].

Objectives

The aim of this research is to investigate the characteristics and mechanical properties of Nb_2O_5 doped zirconia composites. Samples of partially stabilized-zirconia doped with Nb_2O_5 in amounts of 0,5 and 1 %mol were prepared by sol–gel technique.

Moreover, the samples are sintered using both the conventional sintering (**CS**) and microwave technology (**MW**), a non-convencional method, in order to analyze the mechanical properties and check if there is an improvement, and at the same time to reduce production costs and processing times [3].



References

[1] [Online] American Association of Oral and Maxillofacial Surgeons. Dental implant surgery. http://myoms.org/assets/uploads/documents/Ebook_dental_implant_R.pdf.

[2] M. Oghbaei and O. Mirzaeen. Microwave versus conventional sintering: A review of fundamentals, advantages and applications. *Journal of Alloys and Compounds*, 494:175–189, 2010.

[3] A.Presenda, M.D. Salvador, F.L. Peñaranda, R. Moreno, and A.Borrell. Effect of microwave sintering on microstructure and mechanical properties in Y-TZP materials used for dental applications. *Ceramics International*, 41:101–111, 2015.

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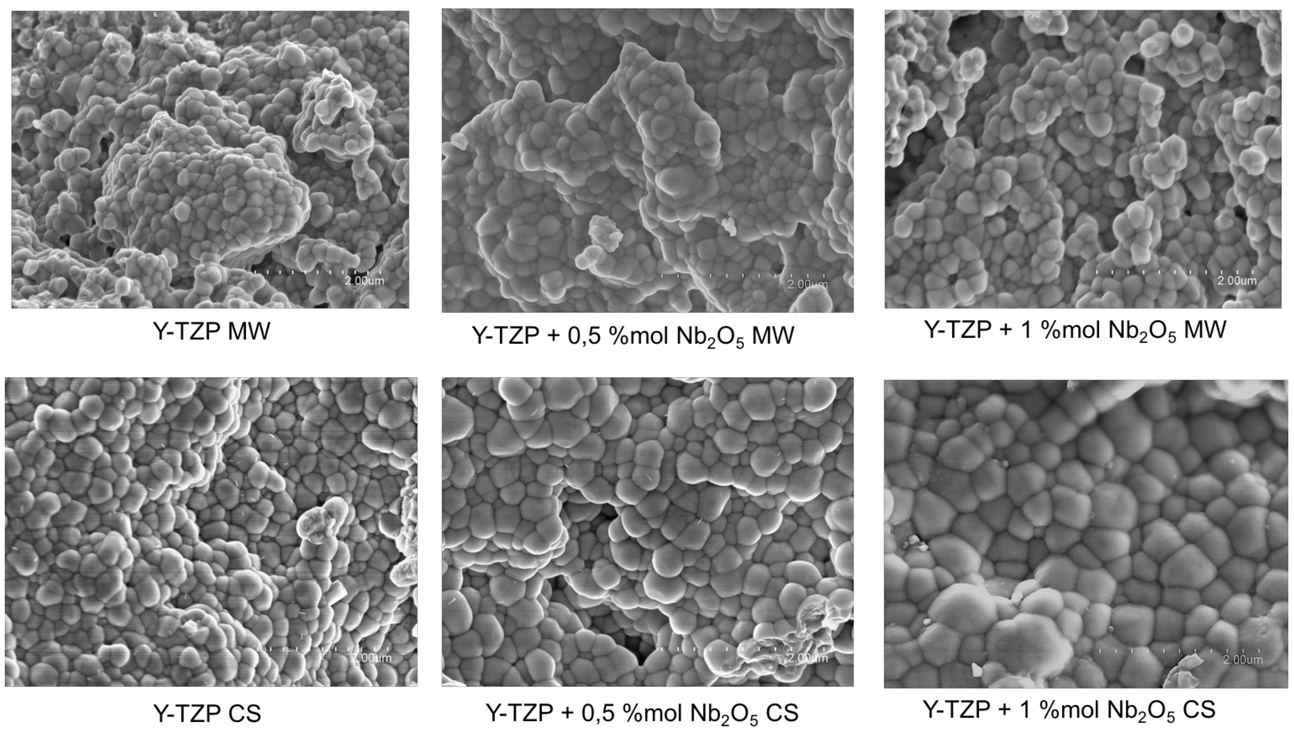
Results

After sintering, the results obtained for density and mechanical properties are shown in the following table.

Table of mechanical properties of sintered material by MW at 1200°C/10min and CS 1400°C/120 min

Sintering Method	Composite	Relative density (%)	Hardness Hv (GPa)	Young Modulus (GPa)	Fracture toughness (MPa·m^2)
MW	Y-TZP	99,2	14,2	253	4,04
	Y-TZP + 0,5%mol Nb_2O_5	98,4	11,9	199	4,87
	Y-TZP + 1%mol Nb_2O_5	98,2	10,4	195	5,33
CS	Y-TZP	98,7	13,3	267	4,34
	Y-TZP + 0,5%mol Nb_2O_5	98,6	12,5	252	4,79
	Y-TZP + 1%mol Nb_2O_5	98,3	10,8	222	5,87

Micrographs of the facture surface (FESEM)



Conclusions

- The relative density and hardness of material sintered by MW at 1200°C and CS at 1400°C are practically equal, using lower temperature and 110 min less in the sintering process. Thereby production costs and environmental impact are significantly reduced.
- Doping of zirconia with Nb_2O_5 enhances the toughness fracture behavior of the ceramic bodies. Bodies containing 1 %mol Nb_2O_5 exhibit the best toughness value.