

**THIRTEENTH ANNUAL CONFERENCE**

# **YUCOMAT 2011**

Hunguest Hotel Sun Resort Herceg Novi, Montenegro,  
September 5-9, 2011  
<http://www.mrs-serbia.org.rs>

## **Programme and The Book of Abstracts**

Organised by:  
**Materials Research Society of Serbia**

under the auspices of  
**Federation of European Material Societies**  
and  
**Materials Research Society**

**Title:** THE THIRTEENTH ANNUAL CONFERENCE  
**YUCOMAT 2011**  
Programme and The Book of Abstracts

**Publisher:** Materials Research Society of Serbia  
Knez Mihailova 35/IV, 11000 Belgrade, Serbia  
Phone: +381 11 2185-437; Fax: + 381 11 2185-263  
<http://www.mrs-serbia.org.rs>

**Editor:** Prof. Dr. Dragan P. Uskoković

**Technical editor:** Aleksandra Stojičić

**Cover page:** Aleksandra Stojičić and Milica Ševkušić

**Copyright** © 2011 Materials Research Society of Serbia

**Acknowledgment:**



**Printed in:** Biro Konto  
Sutorina bb, Igalo – Herceg Novi, Montenegro  
Phones: +382-31-670123, 670025, E-mail: [bkonto@t-com.me](mailto:bkonto@t-com.me)  
Circulation: 250 copies. The end of printing: August 2011

O.S.A.4.

## SINTERING OF DEFECT-FREE FUNCTIONALLY GRADED BIOMATERIALS

S. Marković<sup>1</sup>, M. Lukić<sup>1</sup>, S.D. Škapin<sup>2</sup>, D. Uskoković<sup>1</sup>  
<sup>1</sup>*Institute of Technical Sciences of SASA, Belgrade, Serbia,*  
<sup>2</sup>*Jožef Stefan Institute, Ljubljana, Slovenia*

Functionally graded materials (FGMs) with a gradient of chemical, electrical, mechanical and/or biological properties are very attractive because of their superior features compared to conventional materials. It is known that implanted hydroxyapatite (HAp) scaffolds with a porosity gradient which mimicked the architecture of natural bone, induce rapid bone ingrowths into the high-porosity portion and withstand physiological mechanical stresses through the low-porosity region.<sup>1</sup>

Here, three, four and five component hydroxyapatite functionally graded materials (HAp-FGMs) were designed and examined. HAp powders with different stoichiometry denoted as SHAp (stoichiometric, Ca/P = 1.67) and CDHAp (calcium deficient, Ca/P = 1.62) were used. These two powders were chosen since they show different sinterability in the same sintering conditions, yielding different microstructure (density and average grain size) and also mechanical properties which is necessary for tailoring of appropriate functionally graded biomaterials. It is known that during sintering of FGMs composed of powders which show different shrinkage extents, as well as different final density, excessive shape distortion, warping, delamination, cracks and microstructural damages in the FGMs could be produced. Thus, to achieve high-quality graded biomaterials with appropriate functionality without above listed disadvantages, we applied moderate sintering conditions through two step sintering (TSS) process. Furthermore, TSS method was chosen since significantly improved microstructural characteristics of HAp and BCP could be obtained. So, layered samples, produced by powder-stacking method and uniaxially-pressing process, were transformed in HAp-FGMs by TSS: the samples were heated up to 900 °C and after retention for 5 min the samples were cooled down to 850 °C and kept for 20 h. The microstructure and Ca/P ratio of the prepared HAp-FGMs were examined by FESEM and EDS methods; mechanical characteristics were analyzed by nanoindentation.

1. Tampieri A, Celotti G, Sprio S, Delcegliano A, Franzese S. Porosity-graded hydroxyapatite ceramics to replace natural bone. *Biomaterials* 2001, **22**, 1365–70.