HIGH-TEMPERATURE MICROSCOPY: A PRACTICAL TOOL FOR BIOCERAMICS COMPOSITES EXAMINATIONS

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[ENGINEERING OF BIOMATERIALS 143 (2017) 45]

Introduction

High-temperature microscopy (HTM) is a great characterization technique, that allows to investigate the thermal behavior of material under the heating. This method is appropriate for examinations of glasses, slags, ceramics, glazes and various of raw materials by *real-time* observe and record (photo capture or video record) sample contours changes with temperature increase. Results of HTM provides valuable information of the characteristic temperatures of material (i.e. sintering softening, melting and flowing) and also viscosity, wettability and surface tension and also can be very useful for biomaterials characterization [1-3].

Materials and Methods

In this work HTM was used to evaluate the ceramics biocomposites modified with two kinds of sol-gel bioactive glasses (SBG) addition. The SBG glasses were from the SiO_2-CaO-P_2O_5 system with high CaO or high SiO_2 content. The composites were fabricated with different SBG content combined with TCP (Tricalcium phosphate), HA (Hydroxyapatite) as well as titanium dioxide (TiO_2). The experiment was proceed until temperature reached 1400□C or sample was completely melted. The HTM examinations were performed in order to estimate the characteristic temperatures of prepared samples i.e. sintering, softening, melting and flowing.

Results and Discussion

Results of conducted high-temperature microscopy examinations showed that for all types of composites it was possible to estimate the sintering temperatures. For composites modified with high CaO content SBG also melting and flowing temperatures were pointed. Obtained data were used to established the sintering curves of the materials. The differences in characteristic temperatures were mostly caused by the chemical composition of the bioactive glasses used as composites addition. Generally the glass with high SiO_2 content did not significantly influenced the thermal behaviour of bioceramics composites. Meanwhile addition of high CaO content glass resulted in lower sintering and softening temperatures in comparison with raw HA, TCP and TiO_2 materials as well as melting and flowing occurred.

Conclusions

In order to obtain ceramics biocomposites it is necessary to prosecute sintering process in adequate temperatures, in this work we demonstrated that High-Temperature Microscopy is perfect method for this assignment.

Acknowledgments

This study was carried out within the AGH University of Science and Technology (Krakow), Grants Number: 11.11.160.365 and 15.11.160.203(B3).

References

[1] Cahn R.W., Haasen P., Cramer E.J., "Materials Science and Technology, Vol. 2B: Characterisation of Materials", Wiley-VCH, 1993

[2] Shelby, J.E., Introduction to Glass Science and Technology (2nd ed.). The Royal Society of Chemistry, Cambridge, 2005

[3] Amelinckx S., van Dyck D., van Landuyt J., van Tendeloo G., "Handbook of Microscopy, Applications in Materials Science, Solid-State Physics and Chemistry", VCH, Weinheim, 1997