PHYSICAL CHEMISTRY 2006

Proceedings

of the 8th International Conference on Fundamental and Applied Aspects of Physical Chemistry

September 26-29,
Belgrade, Serbia

ISBN	86-82139-26-X
Title:	Physical Chemistry 2006. (Proceedings)
Editors	Prof. dr A. Antić-Jovanović
Published by:	The Society of Physical Chemists of Serbia, Studentski trg 12-16, P.O.Box 137, 11001 Belgrade, Serbia
Publisher:	Society of Physical Chemists of Serbia
For publisher:	Prof. dr S. Anić, president of the Society of Physical Chemists of Serbia
Printed by:	"Jovan" Printing and Published Comp; 250 Copies; Number of Pages: x + 442; Format B5; Printing finished in September 2006.
Text and Layout:	Aleksandar Nikolić

250 – copy printing

PREPARATION OF COMPOSITE MATERIAL BCP/DLPLG WITH A DIFFERENT CONTENT OF CERAMIC AND POLYMER COMPONENT

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Abstract

Using a new approach of synthesis, homogenisation of DLPLG polymer powder and BCP gel, BCP/DLPLG composite material has been obtained with morphological and structural characteristics making it potentially very suitable for practical application in certain fields of the reconstructive medicine. The composite material has been synthesised with different ratios of ceramics and polymer BCP/DLPLG; 65/35w/w, 10/90 w/w, 5/95 w/w and 2/98w/w. The samples were characterized by Differential Scanning Calorimetry (DSC) and Scanning Electron Microscopy (SEM).

Introduction

Until now, various approaches were followed for obtaining composite material on ceramic basis and copolymer poly(DL-lactide-co-glycolide). Synthesis were performed either with solid component hydroxyapatite (HAp) being added into DLPLG solution of some solvent (dioxan, chloroform), or HAp powder was mixed with DLPLG powder [1], or DLPLG solution was infiltrated into melted apatite [2,3]. Until now synthesis where DLPLG powder was homogenized with BCP gel was not performed. This is why one of the aims of this investigation is obtaining the composite material with certain application characteristics using new BCP/DLPLG synthesis approach out of which successful implementation will greatly depend [4].

Experimental

Biphasic calcium phosphate was synthesised with precipitancy technique from calcium nitrate $Ca(NO_3)_2 \times 4H_2O$ and ammonium phosphate $(NH_4)_3 PO_4$ in the alkali environment, which was then homogenized with polymer DLPLG powder in the appropriate ratio. Copolymer powder DLPLG was obtained with chemical method from the commercial granules, using chemical method with solvent/non-solvent systems, where the obtained solutions were afterwards centrifuged. DSC measurements were executed on Perkin-Elmer DSC-2 differential scanning calorimeter equipped with date processing system. The range of the temperature in which the measurements were performed was between 320K and 540K. The morphology of obtained particles of BCP/DLPLG were examined by scanning electron microscope (SEM) JEOL-JSM-646OLV with electron energy from 10 to 50 KeV.

Results and Discusion

On DSC diagrams of BCP/DLPLG we can see the peek of the glass transition because DLPLG copolymer is amorphous and BCP is thermally stabile in the specified temperature range. With the increase of the copolymer participation in the composite, it is noticeable that peek of the glass transition is shifted toward lower temperatures, which is explained with the change of flexibility of the polymer chain [2]. The peek of the glass transition of the composite BCP/DLPLG 65/35w/w is on temperature 327.9K, BCP/DLPLG 10/90w/w is on 325.0K, BCP/DLPLG 5/95w/w is on temperature 323.6K while the peek for BCP/DLPLG 2/98w/w is on temperature 323.9K (fig. 1).

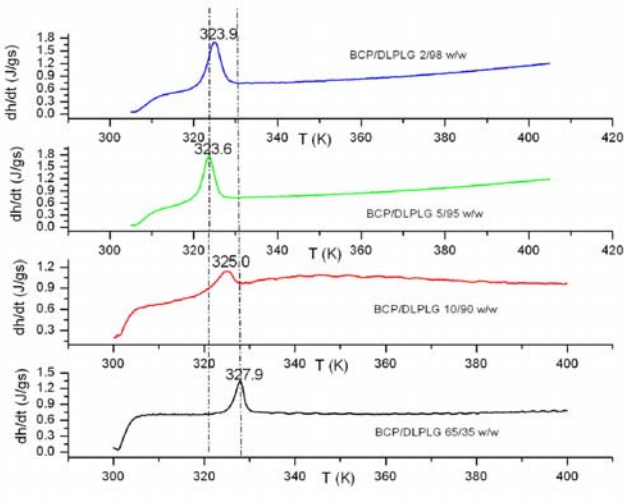

Fig. 1. DSC graph of BCP/DLPLG composite

From SEM pictures of BCP/DLPLG composite (Fig. 2) with the deferent ratios of ceramics and polymer, in cases with higher participation of polymer, it can be noted that particles are lesser agglomerated, more homogenised, spherical and with more regular shapes. It is obvious that non-homogenised distribution of BCP and DLPLG particles in the composite is more present with lesser participation of DLPLG.

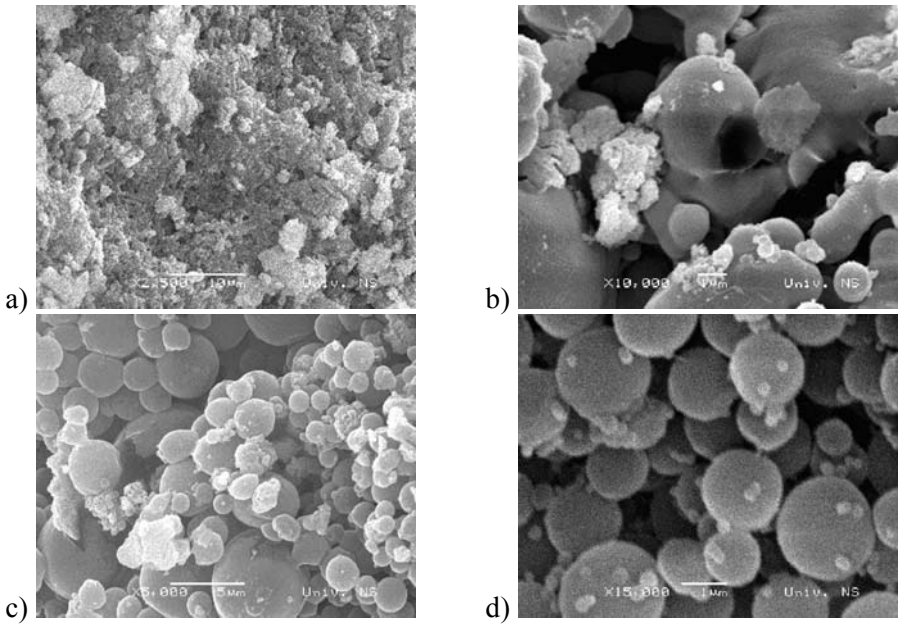

Fig. 2. SEM pictures of the composite a) BCP/DLPLG 65/35 w/w b)BCP/DLPLG 10/90 w/w c) BCP/DLPLG 5/95 w/w d) BCP/DLPLG 2/98 w/w

Conclusion

Homogenising of DLPLG polymer powder and BCP gel it is possible to obtain BCP/DLPLG composite material with morphological and structural characteristics which makes it potentially very suitable for use in certain fields of the reconstructive medicine. The composite material with the higher content of the polymer is less agglomerated; the particles are with more regular shapes and also better mutual distribution of the phases is achieved.

Acknowledgements

Authors would like to thank Miloš Bokorov for his help in SEM analysis. The Ministry of Science and Environmental Protection of Republic of Serbia supports this work through the project No. 142006.

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