

17th International Conference and Exhibition on NANOMEDICINE AND NANOTECHNOLOGY IN HEALTHCARE

November 23-24, 2017 Melbourne, Australia

Modification of PMMA based bone cement with hydroxyapatite ceramics

Witold Kaczorowski, Anna Laska, Anna Sobczyk-Guzenda, Malgorzata Raczyńska, Hieronim Szymanowski and Piotr Niedzielski
Lodz University of Technology, Poland

Bone cements are mainly used for fastening joint endoprostheses and filling up bone deficiencies. Other applications comprise vertebroplasty and kyphoplasty, i.e., therapies consisting in filling bone cement to vertebrae, as well as stabilization of bone fractures. Such cements constitute heterogeneous mixtures of one or more active phases dispersed in a liquid binding agent. They should be non-toxic, biocompatible and free of allergic interactions. In addition, they should be characterized by bioactivity, i.e. the ability to bind bone tissue with chemical bonds. The most popular cements, based on poly (methylmethacrylate) (PMMA), have a number of drawbacks—among others they are characterized by polymerization shrinkage and poor adhesion to bone surfaces. One way to overcome these obstacles is to use ceramic hydroxyapatite (HAp) filler. The work presents results of structural, morphological, physical and mechanical studies of HAp/PMMA composite material. Hydroxyapatite was obtained with wet-precipitation technique. Its grain size fraction of 0.025 to 0.05 mm was used, with the HAp content in the composites amounting to 1, 3 and 6% by weight. Fourier transform infrared spectroscopic measurements of those composites revealed a presence of chemical bonding typical for PMMA and HAp. Scanning electron microscope observations have shown, in the case of 6%, a presence of large agglomerates worsening mechanical properties of the composites and namely lowering their hardness. Increasing HAp content has an effect of slowing down PMMA polymerization and, therefore, extending composite polymerization time. An addition of ceramic filler does not affect surface energy of the composite as compared to plain PMMA.

Biography

Witold Kaczorowski is an Assistant Professor in the Institute of Materials Science and Engineering at Lodz University of Technology, Poland. He has defended his PhD thesis in 2005 at the Mechanical Faculty of Lodz University of Technology. In 2006, he was promoted to DSc level in the Institute of Materials Science and Engineering at Lodz University of Technology. He is an author of one monograph, 3 chapters in books, about 30 scientific papers and 6 patents and patent applications. He has been a Post-doctorate at the University of Alabama at Birmingham and Technical University of Liberec. His research areas include the area of polymer surface engineering, carbon materials, especially DLC (diamond-like carbon), NCD (nanocrystalline diamond) coatings, wood-base materials and nano-carbon powders.

witold.kaczorowski@p.lodz.pl