DESCRIPTION FOR THE GENERAL PUBLIC

The worldwide number of orthopaedic surgical operations performed is growing steadily due, in part, to the combination of the longer average human life span and more active lifestyles. In the United States alone, 152,000 total hip replacement and 299,000 knee replacement operations were undertaken and 59,000 revisions of hip and knee replacements were carried out in 2000 while in 2004 234,000 total hip replacements and 478,000 total knee replacements were performed, so that now over $5 billion is being spent annually on orthopaedic related conditions. It is estimated that the annual number of hip replacements in the United States will rise to 600,000 by 2015 - these procedures become more popular, because many patients want to continue to lead an active life for long time. Now, poly(methyl methacrylate) (PMMA) bone cement is widely used in orthopaedic surgery, mainly for fixation of prostheses but also for stabilizing compressive vertebral fractures or filling bone deffects. Acrylic bone cements have been used in total joint arthroplasty since Sir John Charnley developed his low-friction arthroplasty of the hip in the late 1950s. They were composed of cold-polymerized poly(methylmethacrylate), which reached the final setting in situ and could thus serve as an elastic buffer, maintaining the prosthesis in place and transferring the load from the prosthesis to the bone. Since then, little has changed in the composition of commercially available formulations. Commercial acrylic bone cements are supplied as two components, a polymer powder and a liquid monomer. Mixing of the two components is followed by a progressive polymerization of the liquid monomer to yield a solid mass, a high level of heat being generated during this exothermic reaction. The two major and still unsolved problems that have been reported with the use of PMMA cement are thermal necrosis of surrounding bone due to the high heat generation during polymerisation and chemical necrosis due to unreacted monomer release, ultimately resulting in failure of the prosthetic fixation.

The main goal of this project is fabrication and investigation of properties of a new generation of multifunctional polyurethane-based bone cements reinforced with bioactive bioceramics nad magnetic particles with polymerization temperature control system induced by phase change materials (PCMs).