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Summary of doctoral dissertation titled:

"Synthesis and properties of bioresorbable polymer materials with shape memory behavior"

Shape memory polymers are new interesting materials, with potential applications spanning various areas of everyday life. Especially interesting seems to be the use of such kind of materials in medicine. Particularly valuable in such applications is the ability to use bioresorbable polymers can present the shape memory behavior induced thermally. It allows the development of new surgical devices such as self-expanded stents or self-clamped clips which, after implantation and the fulfillment of the tasks, will be completely bioresorbable. Especially valuable would be to use such materials as scaffolds for the treatment of large bone defects, or self - crimping surgical stents and clamps in the treatment of blood vessels.

The work shows the possibility of obtaining a wide range of bioresorbable polymers presented shape memory effect, with different thermal and mechanical properties and degradation profiles. Mainly, I synthetized the biocompatible copolymers by ring-opening polymerization of cyclic monomers such as; glycolide, lactide, ε-caprolactone and trimethylene carbonate in the presence of non-toxic initiators based on zirconium and zinc compounds.

I introduced that by the proper selection of the comonomers, the reaction mixture composition and conditions as well method of synthesis is possible development of copolymers chain microstructure of obtained copolymers, which is directly connected with the final copolymers properties. On this way is possible also tailoring the temperature and other parameters of shape memory, properly to the predicted application. I also received a series of similar materials by blending the well-known biocompatible poly(L-lactide-*co*-glycolide) and bioresorbable oligocarbonates and oligoesters.

Based of obtained results, I have argued that the crystalline phase in this type of material does not play an essential role in creating expected shape memory properties. The decisive importance in this case, plays rather the chain structures of the copolymers (presence of rigid and flexible blocks), occurrence of the phenomenon of phase separation and the presence of intermolecular interactions. It is possible to control both the time and the temperature ranges of shape return to the permanent shape (the temperature window) not only by the selection of the composition of the obtained polymeric material but also by the

introduction of additional covalent cross-linking or presence of hydrogen bonding. In some cases, this phenomenon opens the way for the preparation of polymeric materials with memory of two different shapes.

Interesting from the point of planed medical application is also that by selecting the temperature and method used during temporary shape programming process is possible to control stress generated after returning to a permanent shape. Some preliminary results which are included in the work, illustrate progress of degradation conducted in vitro conditions and biocompatibility of selected most promising groups of obtained and described materials, confirm their potential usefulness. The models of stents, clamps and 3D scaffolds, based on these terpolymers, presented shape memory, was formed and assessed for suitability and functionality.

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