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# ABSTRACT

Biodegradable alloys based on magnesium are new group of biomaterials with an interesting properties. These biomaterials will be gradually dissolved and removed from implanted organism after they fulfilling their role without necessity of surgery removal.

Monothematic set of publications concerns on development and examination of the properties of bulk and the porous ultrafine-grained biocomposites based on magnesium with addition of hydroxyapatite or 45S5 Bioglass bioceramic. Porous materials were produced using ammonium bicarbonate ($NH_4HCO_3$) as space holder materials, which enable ingrowth of bone tissue into material and creation of blood vessels network with limited metalosis phenomenon with optimal mechanical properties. Optimal chemical and phase compositions of metal matrix, bioceramic and space holder material addition were specified to obtain optimal properties for potential biomedical applications. As a metal matrix of composites two groups of alloys were used Mg-Mn-Zn-Zr and Mg-RE-Zr (RE-rare earths elements: yttrium and dysprosium). Metallic and bioceramic powders after initial mechanical alloying (MA) were blended with ammonium bicarbonate powder and then cold compacted. As a strengthen phase hydroxyapatite (HA, $Ca_{10}(PO_4)_6(OH)_2$) bioceramic with high biocompatibility and ability to binding with bone tissue. In a part of research as strengthen phase 45S5 Bioglass bioceramic were used with chemical composition of 45% $SiO_2$, 24,5 % CaO, 24,5% $Na_2O$, 6% $P_2O_5$. Research were conducted in range of 0-10 wt. % addition of bioceramics. In parts of produced materials 1 wt. % of silver were added in order to improve of antibacterial activity of biocomposites. Structure, morphology, mechanical properties and corrosion resistance of so produced materials were studied in order to specify optimal production process parameters of biocomposites based of magnesium.

In order to obtain ultrafine-grained biocomposites with optimal structure, morphology and properties different combination of process were studied. For the samples with the best properties surface modification process were conducted. Production parameters were connected with structure, morphology, hardness and corrosion resistance. At the final stage of research biocompatibility studies based on *in vitro* tests were conducted to specify ability of cells to growth and survival on produced Mg-based biomaterials.

Obtained results suggests that investigated alloys and composites were characterized with improved properties compared to microcrystalline magnesium. Proposed chemical composition modification by biocompatible elements addition (Mn, Zn, Zr) and RE elements (Dy, Y) improves properties of tested biocomposites. Both bioceramic and silver addition leads to obtain finer microstructure and surface modification methods lead to improvement of corrosion resistance and biocompatibility of tested materials.

Developed and tested materials could find future applications in implantology and surgery, as well as in industry as catalytic materials.