The thesis aim was to produce three- (Ti-xTa-yMg/Zn/Ag, x = 30, 40wt%; y = 3, 5wt%), four-components bulk alloys (Ti25Ta10Mn5Mg, Ti30Ta10Mn3Mg, Ti30Ta10Mn5Mg) and metallic foams based on ternary systems (Ti-30Ta-xMg, x = 30, 40, 50wt%; Ti-xTa-yAg, x = 30, 40wt%; y = 3, 5wt%), and then examine the influence of alloy additions on the properties of the Ti alloys. In addition, the impact of hot-pressing with induction heating (HFIH HP) and spark-plasma sintering (SPS) of the mechanically alloyed powders on the behaviour of four-components alloys was investigated. The effect of porosity and its percentage share on the mechanical properties of metallic foams was tested.

The obtained materials were closely inspected: structural with the use of the X-ray diffraction method, microstructure with the help of optical as well as scanning and transmission electron microscopy, surface wettability by measuring the contact angles of liquid drops, corrosion resistance in Ringer's solution with the aid of potentiostat and mechanical properties with a nanoindenter. Cytotoxicity against osteoblast and fibroblast was determined for ternary alloys and bacteriostatic against *S. aureus*, *P. aeruginosa*, and *C. albicans* for alloys with Ag as the additive.

As a result of the mechanical alloying, nanocrystalline, homogeneous materials with clearly marked Ti-β phase were achieved. The presence of magnesium in the alloy positively affects the mechanical alloying process. It also can be used as a removed space-holder for metallic foams in Ti-Ta alloys. The presence of 60-76% porosity significantly affects the reduction of mechanical properties (R_m = 10 – 15 MPa, E < 1 GPa). After the powders consolidation process to form of bulk alloys, there is an apparent increase in the share of the Ti-β phase, with simultaneous grain refinement, along with the rise in the concentration of the alloy additives i.e. in Ti25Ta10Mn5Mg and Ti30Ta10Mn5Mg after HFIH HP the grain size is 94,5 and 71,2 nm respectively, and after SPS 117 and 99,2 nm. The Young's modulus of solid materials decreases with a more significant share of the Ti-β phase, i.e. in Ti25Ta10Mn5Mg and Ti30Ta10Mn5Mg after HFIH HP, E is 98,1 and 118 GPa respectively, and after SPS is 138 and 148 GPa respectively. The corrosion resistance improves with a higher number of alloying additives. Non-porous alloys exhibit moderately hydrophilic surface properties (the water droplet's contact angle is between 50 and 75°). Cell proliferation on the surface of ternary alloys was similar to or better than of CP-Ti.

Solid alloys produced with chosen parameters were characterized with nano- or ultrafine grain. Introducing a certain amount of Mg to Ti-Ta-based alloys can positively affect the course of many processes (powder yield, shortening mechanical alloying process, shortening consolidation processes) and also participate in refining the alloy of oxygen. The influence of the selected method and scale on the procedure of consolidation and the final properties of the alloy was observed. Slightly better properties, with a finer microstructure, were found in the alloys obtained after the hot-pressing (HFIH HP) technique, especially Ti25Ta10Mn5Mg and Ti30Ta10Mn5Mg alloys, which belong to the Ti-Ta-Mn-Mg group, are most promising among investigated