THEORETICAL AND EXPERIMENTAL RESEARCHES REGARDING THE OBTAINING OF NEW HIGH ENTROPY ALLOYS WITH BIOCOMPATIBLE PROPERTIES

High entropy alloys are a new class of metallic materials with a distinct synthesis strategy, different from conventional alloys, which are based on one or two main elements, because they are composed of five or more main elements. These materials have a great innovative potential, due to the multitude of attractive characteristics, which give high entropy alloys a great potential for use in a wide range of industrial applications. In order to demonstrate efficiency in use, biomaterials must have good mechanical and surface properties (surface tension, roughness), oxidation resistance and biocompatibility properties. Therefore, high entropy alloys with biocompatible properties are an option with superior characteristics compared to biocompatible materials traditionally used for implants or prostheses. In the thesis is used the thermodynamic and kinetic simulation program, MatCalc, and are calculated the criteria for the formation of solid solutions in high entropy alloys, in order to project the optimal compositions. They were elaborated in the induction furnace, using the melting – casting method and then heat treated, in order to homogenize and refine the internal structure. Also, to the obtained alloys were applied chemical characterization and optical techniques, X-ray diffraction, electron microscopy and also were determined the mechanical and corrosion resistances. Finally, the alloy with the best properties was selected, using the sorting technique by similarity to the ideal solution, TOPSIS.

The doctoral thesis brings original contributions, both in terms of scientific and technological application, which can open new perspectives in the selection, design and development of new materials with biocompatible properties.

Keywords: high entropy alloys, biocompatibility, mathematical model, elaboration, characterisation, properties.