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CURRENT TRENDS IN DESIGN, PROCESSING, AND SURFACE TREATMENT OF NOVEL BIOMEDICAL MATERIALS

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ABSTRACT

Metallic biomedical materials are a special category of engineered materials, used mainly for the replacement or fixation of human bones, healthcare devices, or even as surgical instruments. Up to date, the biomedical materials provide quality of life and proper clinical treatment for bone damages due to accidents or diseases. However, there are still challenges to be overcome to attend to all the clinical needs of the human body [1]. In this scenery, our current research projects are trying to innovate in the design, processing, and surface treatment of biometals, in special for Ti-based alloys and ferrous materials. High entropy alloys (HEAs) are emerging materials that have unique properties to be used in diverse industrial applications. For use as biomaterials, the HEAs should combine high mechanical strength, Young's modulus close to the human bone, and a chemical composition adjusted with non-toxic or allergenic elements. However, the actual HEAs did not match with these requirements, thus it is important the development of novel materials designed for use in the human body [2]. Ferrous materials, such as stainless steel and carbon iron, are low-cost materials employed as surgical instruments and fixation devices. However, their corrosion strength and biocompatibility are restrictions for their use as implants [1]. The plasma electrolytic oxidation (PEO) treatment could be a useful way to improve the surface properties of biometals, once it can form a porous oxide layer decorated with non-toxic oxide species from the electrolyte [3]. And finally, the current knee prosthesis for amputees, which are made of stainless steel, lacks proper mechanical stability and density [4]. Taking it into account, the development of novel Ti-Al-V alloys could be interesting for this application, once the solid solution could combine high strength to density ratio, low Young's modulus, and not elevated cost for use by elderly people. The goal of this

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study is to show the current researches developed by our group in the design, processing, and surface treatment of novel biomedical materials. The results will exhibit the great potentiality of the studied materials for use as biomedical materials, obeying the actual clinical needs and health requirements. (Financial support: CNPq and FAPESP)

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