RESUMO - BIOMATERIAIS

EFFECT OF TIME ON THE SURFACE PROPERTIES OF THE MAO-TREATED TIZRNBMNFEAL BIO-HEA

Jhuliene Elen Muro Torrento (jhuliene.torrento@unesp.br)

Carlos Roberto Grandini (carlos.r.grandini@unesp.br)

Conrado Ramos Moreira Afonso (conrado@ufscar.br)

Diego Rafael Nespeque Correa (diego.correa@unesp.br)

High entropy alloys (HEAs) have been considered for biomedical applications due to their combination of single-crystalline structures, low elastic modulus, and superior mechanical strength. Although the current HEAs do not fully support the complex biomechanical loads of the human body and exhibit inadequate interaction with the biological host, there are promising applications as biomaterials. Additionally, the surface of metallic biomaterials still needs to be improved to become more friendly to the biological environment. In this context, this study aimed to functionalize the surface of a novel Bio-HEA based on non-toxic, low-cost, and non-refractory alloying elements (Ti, Zr, Mn, Al, Nb, and Fe), by micro-arc oxidation (MAO). The ingots were produced by arc melting and then subjected to homogenization heat treatment. Finally, MAO treatment was performed at 300 V and 2.5 A for 1 to 9 minutes in a Ca-, P-, and Mg-rich

electrolyte. The samples after coating surface were characterized by optical, scanning electron, and transmission electron microscopy. Chemical mapping by EDS, XRD, FTIR, XPS, confocal microscopy, and, wettability and tribocorrosion measurements. The MAO-treated samples exhibited a porous surface with microscale thickness and were enriched with elements from both the alloy and the electrolyte, present in chemical states favorable for bone regeneration and corrosion resistance (e.g., TiO_2 and ZrO_2). The oxide layer displayed amorphous and nanocrystalline structures, with a preferential concentration of bioactive ions in the outermost region. These characteristics, combining enhanced corrosion resistance with a rough and hydrophilic surface, suggest promising properties for potential biomedical applications. Furthermore, the treatment time was found to be directly proportional to both the incorporation of elements and the growth of the film, which in turn affected its porosity and thickness. (Financial support: FAPESP #2023/15812-2 and #2021/13921-3)

Palavras-chave: metallic biomaterials; high entropy alloy; surface modification; micro-arc oxidation.