Characterization and corrosion resistance of Mg-Zn-Ca alloys for biomedical applications

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Mg alloys are being actively researched for biodegradable implant applications that avoid second surgery after the healing process is completed. Commercialized implants often use Mg alloys which principally contain rare earth elements, Zr, Y, Zn or Ca. Particularly attractive is the concept of a biomedical grade Mg alloy that contain only the elements involved in human body metabolism, such as Ca, Zn, Si, Mn, Mg. The present work reports on corrosion behaviour of MgZnCa and Mg3Zn0.3Ca alloys in physiological solutions which could be used in biomedical applications for cardiovascular stents and orthopeadic temporal implants. The microstructure and composition of the alloys were analyzed using STEM, EDS and SEM. The surface topography and surface potentials maps were obtained using AFM and SKPFM. The short-term corrosion resistance was tested using hydrogen evolution measurements during immersion in 0.9% NaCl and α-MEM at 37ºC, the latter medium usually used for in vitro osteoblast cell culture. Additionally, liberation of Mg, Zn and Ca ions during 7 days of immersion, a period corresponding to a typical duration of a cell-culture experiment, was investigated using ICP-OES. The role of impurities such as Fe, Al, Si sand the role of inorganic and organic additives in a-MEM on corrosion resistance of the alloys is discussed.