Corrosion behavior of Mg1Zn1Ca and Mg3Zn0.3Ca for biomedical applications

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Biomedical applications require biodegradable, biocompatible and bioactive materials. Magnesium-based alloys are potential materials to accomplish all of them. However, magnesium alloys present some limitations in their use due to the corrosion response. The high corrosion rate and the generation of hydrogen bubbles in their decomposition are the main factors to control. Many efforts to improve their behavior against corrosion have been developed. In the biomaterial field, for temporary medical implants, one approach consists in alloying with elements commonly found in the human body, like calcium and zinc. The objective is to obtain a material able to maintain its mechanical properties during bone healing and to be dissolved, absorbed or removed once that its function has been fulfilled, avoiding a second surgery and the risks derived from it.

In this work, two magnesium alloys have been studied: Mg1Zn1Ca and Mg3Zn0.3Ca for this purpose. Linear polarization resistance testing technique, hydrogen evolution method and in vitro studies have been carried out using the Mg1Zn1Ca and Mg3Zn0.3Ca alloys as-received and after different solution and aging treatments. Finally, the relationship among the thermal treatment, the composition, the microstructure and the corrosion behavior of the magnesium alloys has been established.