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Study on degradation of the new kinds of biodegradable Mg-Zn-Mn-Ca alloys used for vascular stent

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Abstract

Magnesium alloys, as a new type of biodegradable medical metal material, have a promising application in the field of interventional medical devices. In this work, Mg-4Zn-0.2Mn-xCa (0.05~1wt.%) were designed to study the effect of Ca element on the mechanical and corrosion properties of the alloy. And the alloy with 0.2wt.% Ca element has the best comprehensive properties. The micro-tubes for vascular stent application of Mg-4Zn-0.2Mn-0.2Ca alloy with 3.6 mm in outer diameter and 0.4 mm in thickness were prepared by hot extrusion-drawing composite process. The microstructure evolution and mechanical properties of tubes showed that the crystal slip, twins and recrystallization occurred during the plastic deformation, and the work hardening was significant. This drawn tube exhibited a tensile strength of 427.3 MPa, yield strength of 383.4 MPa, and elongation of 5.2%. After annealing at 300℃ for 30 min, the microstructure became uniform and the elongation increased to 18.0%. In vitro degradation of tubes were investigated by means of immersion testing in Hank's simulated solution. The results showed that the corrosion resistance of tubes can be improved by annealing treatment. The long-term immersion tests revealed that the corrosion process of the micro-tubes was relatively uniform. The corrosion rate after immersion for 180 days was 0.3094 mm/y, before complete biodegradable when soaked for 202 days. The results showed that the Mg-4Zn-0.2Mn-0.2Ca alloy exhibited great potential to be used as biodegradable stents.

Biography:

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Speaker Publications:

1. Junjian, Fu & Liu, Ke & Du, Wenbo & Wang, Zhaohui & Li, Shubo & Du, Xian. (2017). Microstructure and mechanical properties of the as-cast Mg-Zn-Mn-Ca alloys. IOP Conference Series: Materials Science and Engineering. 182. 012053. 10.1088/1757-899X/182/1/012053.

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