Mg-Li-Ca alloys produced by laser powder bed fusion

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Magnesium (Mg) alloys are used as biomaterials because of their biocompatibility and stiffness which is similar to that of human bone tissue. This reduces the stress shielding complications associated with bone resorption. Mg is one of the fundamental divalent ions that have an effect on bone-forming cells and also plays an important role in bone metabolism. This is supported by the results of *in vivo* studies, which indicate that Mg degradation does not damage surrounding tissue and promotes bone remodelling [ref]. One of the main drawbacks limiting the wide use of Mg alloys in biomedicine is their low corrosion resistance, and associated high hydrogen release in the surrounding environment which causes pain in the area of implant placement [1–3]. Additive manufacturing is an attractive alternative to conventional manufacturing of Mg alloys, and researchers have so far studied the properties of the following Mg-based alloys: Mg-Al-Zn, Mg-Zn-Zr, and REE- containing alloys [4].

In this research, we propose to develop possibilities of fabrication of Mg-based alloys enriched with Li and Ca which will decrease the density of the alloys and simultaneously improve mechanical properties of the alloys. It is expected to create ultra-refined microstructure which should lead to the lowering of the intensity of the occurring corrosion mechanisms. We decided to work on the Mg-4Li-0.5Ca and Mg-8Li-0.5Ca compositions. As a reference cast materials with the same composition were used. The microstructure of alloys was analyzed through electron back scattered diffraction and phase composition was analyzed using X-ray. Corrosion resistance of both alloys were performed using various electrochemical techniques in phosphate-buffered saline solution (PBS). The materials corrosion rate was investigated by hydrogen evolution tests, and corroded specimens were characterized by SEM and optical profilometer observations. Our results show that ultrafine grained microstructure was formed in Mg-4Li-Ca and Mg-8Li-Ca. It should be the main reason of the corrosion resistance improvement.

Keywords: Mg alloys, LPBF, SEM

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