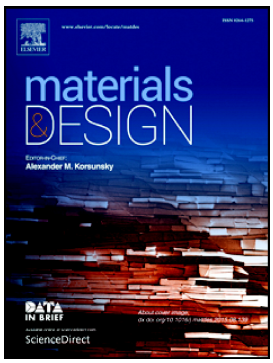

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S and B microalloying of biodegradable Fe-30Mn-1C – effects on microstructure, tensile properties, *in vitro* degradation and cytotoxicity

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Abstract

Austenitic Fe-Mn-C-based alloys are considered as promising candidates for biodegradable vascular implants due to their high strength, ductility and mechanical integrity during degradation.

The present study demonstrates that microalloying with S and B is an effective method to further enhance the degradation rate and the mechanical properties of a Fe-30Mn-1C twinning-induced plasticity (TWIP) alloy without deteriorating the biocompatibility. For studying the microstructural changes due to S or B addition, the alloys were analysed by X-ray diffraction (XRD) as well as scanning electron microscopy (SEM) in combination with energy-dispersive X-ray spectroscopy (EDX), wavelength dispersive X-ray analysis (WDX) and electron backscatter diffraction (EBSD). Thereby precipitates of $(Fe_{0.3}Mn_{0.7})S$ and $(Fe,Mn)_{23}(C_3B_3)$ types were detected in the austenitic matrix. These precipitates have a distinct influence not only on the mechanical properties under tensile load but also on the occurring corrosion mechanism. This was displayed by potentiodynamic polarization measurements and immersion tests in simulated body fluid (SBF) and associated SEM as well as X-ray photoelectron spectroscopy (XPS) investigations. *In vitro* cytotoxicity analyses with L929 fibroblast cells indicated that microalloying with S and B does not affect the cytocompatibility.

Thus, the novel alloy modifications show a high potential for future application as biodegradable implant material.

Keywords

Fe-based alloy; biodegradable; microstructure; mechanical properties; corrosion behavior; cytocompatibility