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Biodegradability of an FeMn17 alloy

Matjaž Godec, Irena Paulin, Črtomir Donik, Matej Hočevar, Franc Tehovnik and **Aleksandra Kocijan**
Institute of Metals and Technology, Slovenia

Metallic materials play an essential role as biomaterials to assist with the repair or replacement of bone tissue that has become diseased or damaged. Plates, screws and pins used to secure serious fractures must be removed by a second surgical procedure after the tissue has healed sufficiently. Repeated surgery increases costs to the health care system and risk to the patient. To overcome these problems biodegradable materials can be used which temporarily support tissue healing and are completely degraded in certain time. Fe-Mn alloys are promising candidates for biodegradable metallic materials because of excellent mechanical properties, which are usually obtained by multi stage forming processes. However, biodegradability rate is usually not sufficient and last too long, degradation is not continuous and sometimes flakes are formed. The main goal of current research is to understand different production processes: casting, hot rolling and annealing; on the corrosion behavior of the biodegradable FeMn17 alloy due to the formation of less-corrosion-resistant deformational martensite. With additions of Mn the mechanical properties increase and the corrosion resistance decreases. The process parameters influenced the biodegradability as well as the mechanical properties. The produced material, cast and hot rolled, has interior stress and that increases the biodegradability, though the annealing process increases the stability of the material and the corrosion resistance.

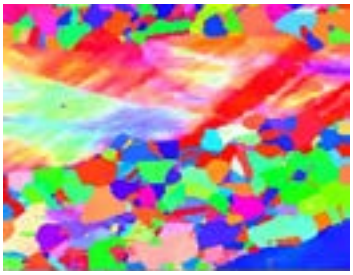

Figure 1: EBSD-IPF map of FeMn17 after hot rolling.

Recent Publications

1. Hermawan H, (2012) Biodegradable Metals. From Concept to Applications. Springer Verlag Berlin Hiedelberg. Doi: 10.1007/978-3-642-31170-3.
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3. Schinhammer M, Hänzi A, Löffler J, Uggowitzer P (2010) Design strategy for biodegradable Fe-based alloys for medical applications. Acta Biomater. 6(5):1705-1713.
4. Hufenbach J, Wendrock H, Kochta F, Kühn U, Gebert A (2017) Novel biodegradable Fe-Mn-C-S alloy with superior mechanical and corrosion properties. Materials Letters. 186:330-333.
5. Kocijan A, Paulin I, Donik Č, Hočevar M, Zelič K, Godec M (2016) Influence of Different Production Processes on the Biodegradability of an FeMn17 Alloy. Materials and Technology. 50(5):805-811

Biography

Matjaž Godec has his expertise in characterization of metallic materials, especially using EBSD technique. His research interests are metallic materials characterization (SEM, TEM, AES, XPS), physical-chemistry of metallic surfaces, biodegradability of metallic materials, rapid solidification technology, tool steels carbides transformation, EBSD analysis of carbides, metallic materials surface nanostructuring, R&D of different steel grades and R&D of aluminum alloys. He is the Director of Institute of Metals and Technology, Ljubljana, Slovenia since 2011 and is a Group Leader of Physics and Chemistry of Surfaces of Metallic Materials.

matjaz.godec@imt.si