World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:13, No:12, 2019

Mechanical Properties of Powder Metallurgy Processed Biodegradable Zn-Based Alloy for Biomedical Application

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Abstract : Zinc is a non-ferrous metal with potential application in orthopaedic implant materials. However, its poor mechanical properties were major challenge to its application. Therefore, this paper studies the mechanical properties of biodegradable Zn-based alloy for biomedical application. Pure zinc powder with varying (0, 1, 2, 3 & 6) wt% of magnesium powders were ball milled using ball-to-powder ratio (B:P) of 10:1 at 350 rpm for 4 hours. The resulting milled powders were compacted and sintered at 300 MPa and 350 °C respectively. Microstructural, phase and mechanical properties analyses were performed following American standard of testing and measurement. The results show that magnesium has influence on the mechanical properties of zinc. The compressive strength, hardness and elastic modulus of 210 ± 8.878 MPa, 76 ± 5.707 HV and 45 ± 11.616 GPa respectively as obtained in Zn-2Mg alloy were optimum and meet the minimum requirement of biodegradable metal for orthopaedics application. These results indicate an increase of 111, 93 and 93% in compressive strength, hardness and elastic modulus respectively as compared to pure zinc. The increase in mechanical properties was adduced to effectiveness of compaction pressure and intermetallic phase formation within the matrix resulting in high dislocation density for improving strength. The study concluded that, Zn-2Mg alloy with optimum mechanical properties can therefore be considered a potential candidate for orthopaedic application.

Keywords : Biodegradable metal, Biomedical application, Mechanical properties, Powder Metallurgy, Zinc
Conference Title : ICPMT 2019 : International Conference on Powder Metallurgy and Technology
Conference Location : Dubai, United Arab Emirates
Conference Dates : December 19-20, 2019