World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:11, No:09, 2017

Biocompatible Porous Titanium Scaffolds Produced Using a Novel Space Holder Technique

Authors : Yunhui Chen, Damon Kent, Matthew Dargusch

Abstract : Synthetic scaffolds are a highly promising new approach to replace both autografts and allografts to repair and remodel damaged bone tissue. Biocompatible porous titanium scaffold was manufactured through a powder metallurgy approach. Magnesium powder was used as space holder material which was compacted with titanium powder and removed during sintering. Evaluation of the porosity and mechanical properties showed a high level of compatibility with human bone. Interconnectivity between pores is higher than 95% for porosity as low as 30%. The elastic moduli are 39 GPa, 16 GPa and 9 GPa for 30%, 40% and 50% porosity samples which match well to that of natural bone (4-30 GPa). The yield strengths for 30% and 40% porosity samples of 315 MPa and 175 MPa are superior to that of human bone (130-180 MPa). In-vitro cell culture tests on the scaffold samples using Human Mesenchymal Stem Cells (hMSCs) demonstrated their biocompatibility and indicated osseointegration potential. The scaffolds allowed cells to adhere and spread both on the surface and inside the pore structures. With increasing levels of porosity/interconnectivity, improved cell proliferation is obtained within the pores. It is concluded that samples with 30% porosity exhibit the best biocompatibility. The results suggest that porous titanium scaffolds generated using this manufacturing route have excellent potential for hard tissue engineering applications.

Keywords : scaffolds, MG-63 cell culture, titanium, space holder
Conference Title : ICPMPT 2017 : International Conference on Powder Metallurgy and Particulate Technology
Conference Location : Paris, France
Conference Dates : September 21-22, 2017