3DPRINTING OF BIOCOMPATIBLE MATERIALS FOR MEDICAL IMPLANTS AND SCAFFOLDS

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Abstract

Biodegradable biometals were fabricated into various shapes via 3DPrinting to evaluate additive manufacturing methods for generation of scaffolds for potential applications in regenerative medicine. It is shown that 3DPrinting is capable of producing the shapes required, including void spaces for placement of cells and growth factors, in Mg- and Fe-based degradable alloys. However, while sintering the Mg alloys is problematic, the Fe-based alloys were sintered to full density. Cytological testing showed that cell growth was compatible with both alloys.

Introduction

Interest in degradable Fe and Mg based biometals has increased rapidly in recent years. The prospect of using these materials in additive manufacturing processes is particularly attractive because this combination of material and process can be used to produce regenerative scaffolds for tissue engineering. The additive manufacturing process permits tailoring the scaffolds to the specific geometry required for tissue repair in any given patient/application.

Proprietary Mg-based alloys have been developed, using Density Functional Theory, that provide controlled degradation of the scaffolds to match the rate of cell growth in the implanted scaffolds. Scaffolds have been printed in these alloys using the ExOne 3DPrinting system, Figure 1. The scaffolds can be produced with controlled pore structures for optimal placement of cells and growth factors pertinent to growth and interaction of the implant with surrounding tissue.

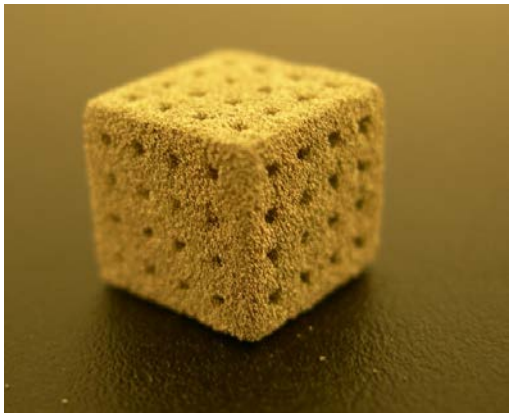

Figure 1. Mg alloy powder produced into a prototype scaffold by 3DPrinting.