A NOVEL MANUFACTURING METHOD FOR TITANIUM FOAM FOR BIOMEDICAL APPLICATIONS

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ABSTRACT

The excellent biocompatible properties of porous titanium make it a popular choice for many biomedical applications, especially due to its high specific strength. This paper introduces a new method for manufacturing titanium foam, where titanium powder is sintered with sodium chloride as the space-holder. The process is capable of producing open-cell titanium foam with controlled cell morphology, cell size and porosity. The samples produced have spherical or angular cells with a cell size of 250 – 425 μm and different porosities of 60-80%. A range of processing conditions including sintering temperature have been investigated. Their effects on the quality of the final specimens, as determined by techniques including SEM, EDX and XPS, have been discussed. It has been found that additional sintering under vacuum produces higher quality samples. The manufacturing conditions can be varied to achieve optimum quality and cleanliness with this new manufacturing method.

INTRODUCTION

Open-cell structures have been investigated by many researchers and compared to human bone [1,2]. A key application for these lies in the area of structural implants. Research shows that open-cell (open-pore) structures can encourage cell growth, improve healing and reduce recovery time, the long term Stress Shielding Effect (SSE) and hence the loosening of the implant. The SSE is a critical issue in load-bearing implants [3,4] as loosening of the implant causes pain and discomfort and eventually leads to the need for a revision. The SSE is notably caused by a mismatch in modulus between the implant and the bone it replaces, although it should be noted that there are several other contributing factors to implant loosening.

For key structural applications such as Total Knee Arthroplasty (TKA) and Total Hip Arthroplasty (THA) primary options include either cemented or cementless fixation. Much research has