Design and Simulation of Porous Ti-6Al-4V alloy structures for Additive Manufacturing of Bioimplants

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**Abstract**

This paper presents the efforts made in design and finite element simulation of porous Ti-6Al-4V alloy structures to determine the elastic modulus of porous parts produced with the additive manufacturing technology for biomedical applications. The major problem concerning with the typically used metallic bioimplants is the mismatch of elastic modulus between the implant and the human bone, which resulted in degradation of surrounding bone structure and disassociation of the implant. The present work focused on design the porous Ti-6Al-4V alloy structures and also study the influence of porosity on elastic modulus of implants made of Ti-6Al-4V alloy material. The three-dimensional strut-based cellular structure employed to build the porous structures ranging from 10% to 50% porosity volume. This work established the appropriate porosity to minimize the mismatch of elastic modulus between the implant and the bone by adding the porosity to the implant structure, and it demonstrates the proof of tailoring the elastic modulus of bioimplants.

***Keywords*:** Additive Manufacturing, Elastic modulus, Porosity, Ti-6Al-4V alloy