Theoretical Treatment and Experimental Verification of Selective Laser Sintered Biopolymer Powders

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ABSTRACT

Tissue engineering is a budding discipline that combines life sciences and engineering know-how. One of the existing challenges for engineers today is the issue of providing good, porous and biodegradable scaffolds with interconnectivity between pores. Numerous methods have been experimented to fabricate polymeric scaffolds; nevertheless the products are still limited by inadequate interconnectivity of macro- and microporosity. Furthermore, many of these methods use hazardous solvents in the processing chain. Rapid prototyping is selected as the fabrication technique of choice as it has already proven its capability to fabricate intricate objects accurately. Selective laser sintering (SLS), a powder-processing rapid prototyping technology is chosen due to its potential to fabricate scaffolds directly from powder biomaterials without incorporating any solvents. SLS utilizes a laser source to fuse powder particles to become 3-dimensional objects. A study on heat transfer phenomena inside SLS chamber is beneficial to relate the biomaterials properties with SLS processing parameters. Derivation of the heat transfer phenomena result in an energy balance relationship between laser source characteristics and biomaterial thermal properties. Sintering trials of poly(vinyl alcohol) to verify the derived energy balance equation shows good correlation. It also shows promising results of further study on SLS for tissue engineering scaffolds application.

Keywords: Tissue engineering scaffolds, selective laser sintering, heat transfer and biomaterials

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