OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Materials Science & Engineering

October 07-09, 2013 Hampton Inn Tropicana, Las Vegas, NV, USA

Hierarchical scaffolds produced by a hybrid solid freeform fabrication/thermally-induced phase separation technique

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The current trend in developing tissue-engineering scaffolds is to use computer aided design combined with solid freeform fabrication (SFF) techniques. This is primarily because the control over scaffold microstructure using conventional techniques is highly process driven, which does not allow a rigorous control over scaffold architecture. However, combining the design-driven macropores with process-driven micropores could lead to hierarchical scaffold architectures with enhanced cell migration and a more efficient transport of oxygen and nutrients. Among conventional scaffold fabrication techniques, thermally induced phase separation (TIPS) is capable of producing microporous scaffolds, where the pore size can be closely controlled by manipulating the process parameters. This work introduces a hybrid SFF-TIPS technique to produce scaffolds with bimodal pore size distribution. Poly (lactic-co-glycolic acid) (PLGA) and poly (L-lactic acid) (PLLA) were used in this study to fabricate the hierarchical constructs. The produced TIPS scaffolds contained macropores, with interconnected channels, generated by the solid freeform fabrication technique. The effect of adding hydroxyapatite (HA) to the formulation was also investigated in this study. Carefully-designed composites of biodegradable polymers and bioactive ceramics can offer adequate mechanical properties, enhanced biocompatibility, improved tissue interaction, and osteoconductivity. In addition, incorporation of HA can modify the pore surface morphology and leads to improved cell attachment. We examined the effect of SFF and TIPS parameters on pore structure, porosity, and mechanical properties. The *in vitro* studies using an osteoblastic cell line are currently underway to evaluate the cell growth outcomes for these macro/microporous constructs.

Biography

Amy Yousefi completed her Ph.D. in Chemical Engineering at University of Montreal in 1996. After postdoctoral studies on computational fluid dynamics (CFD) at the same university, she joined the National Research Council of Canada (NRC) in 1999 as a researcher, where she established a research program on tissue engineering scaffolds. Since 2009, she has been holding a faculty position as a Spooner Schallek Associate Professor at Miami University. She has published 20 papers in reputed journals and has given over 50 conference presentations. Since 2010 she has been working with 4 NIH study sections as a reviewer.

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