BOTM: October 2009

Freeform Fabrication of Photocured PEG Scaffolds for Tissue Engineering

Precise fabrication of tissue engineering constructs enables study of cell behavior and differentiation under controlled settings. Dr. Shaochen Chen's lab at University of Texas, Austin has developed a digital micromirror device (DMD) to create 3D micrometer scale polymer scaffolds for tissue engineering applications. These scaffolds are fabricated using curable materials through an ultraviolet (UV) photopolymerization process. Complex internal architectures can be generated by designing photopolymerization masks of any shape or size. The figure (left) shows a "log cabin" scaffold made from poly (ethylene glycol) diacrylate (PEGDA) using DMD. DMD scaffolds can also be functionalized with biomolecules such as proteins or peptides to impart biochemical activity to the scaffolds. The right image shows D1 osteoblasts that were cultured on a DMD fabricated scaffold that was functionalized with fibronectin. In addition, cells can encapsulated directly into the scaffold struts by mixing cells into the monomer solution prior to photopolymerization. In summary, the DMD approach provides a novel approach for fabricating 3D tissue scaffolds with designer architectures that can be functionalized with biomolecules and fabricated with cells in situ.

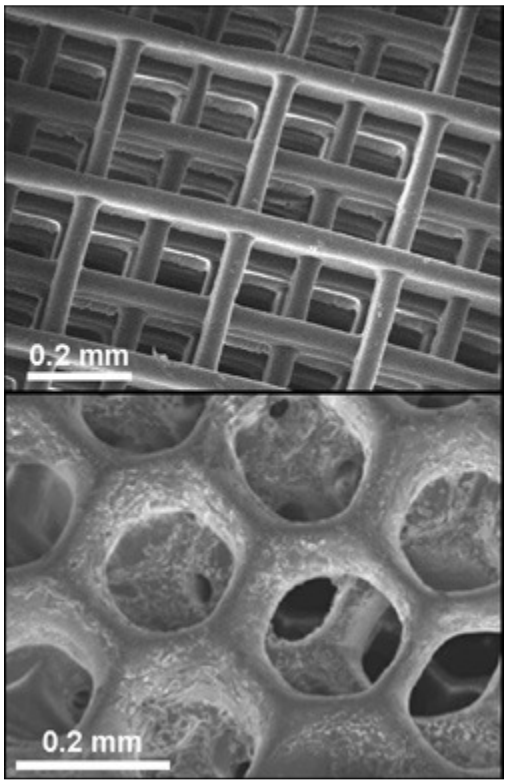

Figure. Scanning electron microscopy (SEM) images of DMD fabricated PEGDA scaffolds. Top image shows a log cabin structure (unpublished results). Bottom image shows a hexagonal structure functionalized with fibronectin that has been seeded with D1 osteoblasts, cultured for 2 d, fixed and imaged (Han et al. 2008, Copyright © 2008 by ASME).

Reference:

Han L-H, Mapili G, Chen S, Roy K (2008) Projection micro-printing of three-dimensional scaffolds for tissue engineering. Journal of Manufacturing Science & Engineering, 130