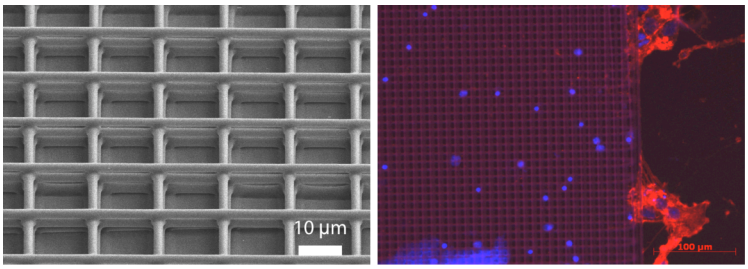
NANOHOUR

Wednesday, March 25, 2009
3:00 PM
Beckman Institute - Room 3269

Direct-Write Assembly of 3D Microperiodic Hydrogel Scaffolds for Tissue Engineering Applications

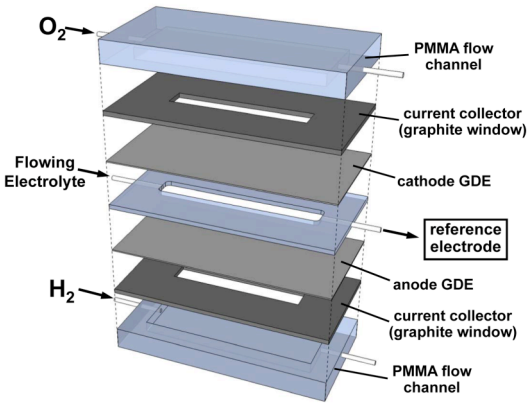
Sara T. Parker—Graduate Student, Materials Science & Engineering



We have fabricated three-dimensional microperiodic scaffolds by direct-write assembly of a concentrated ink, which is composed of poly(2-hydroxyethyl methacrylate) (HEMA) chains, HEMA monomer, crosslinker, photoinitiator, and water. The ink exhibits a viscoelastic response that enables it to flow readily during printing, yet retain its filamentary shape even as it spans gaps in the underlying layer(s). The scaffolds are patterned by extruding this ink through a fine deposition nozzle to form micron-sized hydrogel filaments that are periodically arrayed in three dimensions. After assembly, the printed scaffolds are cross-linked by UV exposure. 3D hydrogel scaffolds with features as small as 2 µm have been constructed. Poly(HEMA) scaffolds are then seeded with developing rat hippocampal neurons and imaged with fluorescence microscopy. Ink design, rheology, mechanical properties, and cell response will be discussed.

Development & Characterization of Novel Cathode Catalysts for Fuel Cells

Fikile Brushett – Graduate Student, Chemical & Biomolecular Engineering



Fuel cells are extensively investigated as efficient power sources for portable electronics and transportation applications. Current efforts focus on improving durability and lowering system costs to enable successful commercialization. *Improving the oxygen reduction reaction (ORR) on the cathode remains a key challenge.* Sluggish kinetics and high overpotentials associated with the ORR hamper both energetic efficiency and peak power production. Furthermore, the high cost and limited availability of platinum (Pt) necessitate the search for and exploration of alternative catalysts. Alloying Pt with transition metals not only reduces catalyst cost but also improves ORR activity compared to pure Pt in acidic media. Unfortunately extended exposure to acidic media leads to transition metal dissolution ("leaching") and performances losses.

Our research goal is to synthesize and characterize novel cathode catalysts that are robust under a wide range of fuel cell operating conditions. We have developed a microfluidic H_2 / O_2 fuel cell with a flowing electrolyte stream instead of a stationary polymer electrolyte membrane. The constantly refreshing stream enables autonomous control over the flow rate and electrolyte composition, as well as independent analysis of the individual electrodes, rendering this platform a powerful analytical tool. Using this platform, we discovered novel durable Pt-Co-Mo alloys with high ORR activity.

Coffee and cookies will be served

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