Dispenser Direct Written Microbatteries

Enabling Conformable On-Chip Secondary Power

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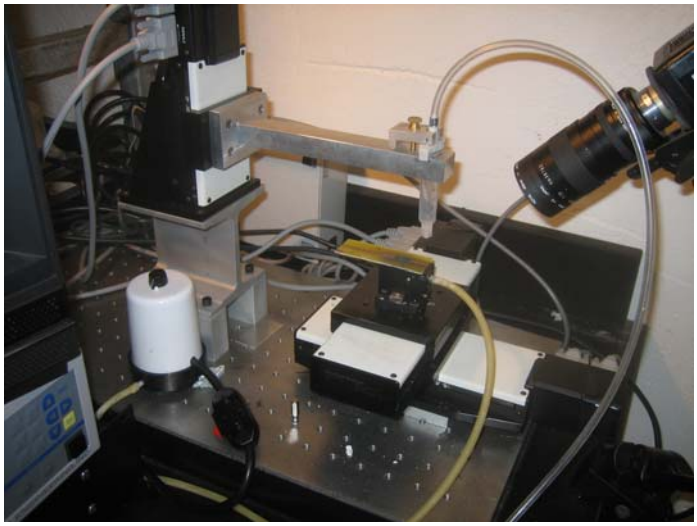
Vision

- Energy storage and generation are the bottleneck for widespread implementation of wireless sensor networks.
- Traditional microfabricaiton does not work well for processing high energy density electrochemical cells.
- We are looking at direct write techniques to create all aspects of an effective lithium ion electrochemical cell: current collectors, anode, cathode, electrolyte and sealant.
- Direct Write Benefits:
  - Easy use of novel materials, solutions and composites
  - Far less waste than conventional subtractive processes
  - Very low cost of operation
  - Small equipment footprint; everything for printing a cell fits readily in a 20 ft^3 argon box



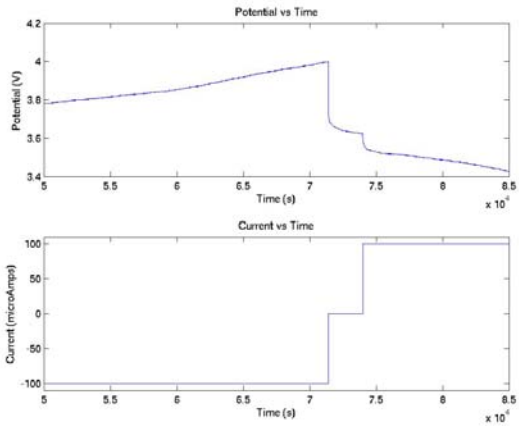
Pneumatically Driven Dispenser Direct Write Printer

Research Questions

- How can multiple precursors be used in a single chamber while minimizing contamination?
- Can successive layers be printed using a single solvent?
- Can this methodology readily manage different chemistries and cell geometries to best match a particular application?

Methods

- We have created a three dimensional printer by combining a micron resolution microscope stage with an electronic pneumatic regulator.
- We mix our own inks for the cell components
- We have developed a high resolution low cost wireless galvanostat / potentiostat, allowing us to test many more cells at a time.



Single Cycle Charge/Discharge Curve for Printed Electrodes

Findings

- Pneumatic dispenser printing provides adequate resolution while creating electrodes thick enough to provide theoretically acceptable energy storage and power delivery.
- Pneumatic dispenser printing is significantly less expensive and faster (for 1 cm^2 area coverage) than ink-jet or laser direct write methods.