Building and Testing a Scanning Electrochemical Probe Microscope

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Nanoscale Materials & Devices | Energy Materials & Devices

Background/Relevance

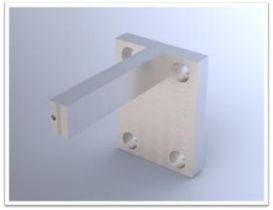
- Electrodes vary on the nano-to-micro length scale.
- In conventional (macro) electrochemical measurements the current is the sum response of the entire surface, obscuring local variability.
- Nanoscale electrochemical measurements can characterize single nanostructures and determine how structure influences electrochemistry.

Innovation

- Build a flexible electrochemical microscope with nanometer resolution with open-source designs for custom parts (source parts, program , test,…).

Approach

- Develop a parts list and specifications for the microscope.
- Procure parts for microscope.
- Design, prototype, and fabricate custom parts, and provide open-source engineering designs for them.
- Assemble and test components.


CAD


3D Print

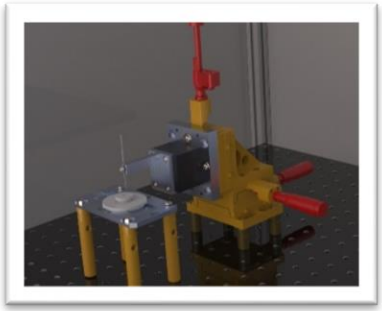

CNC

Key Results

- Connected computer, hardware controller, and breakout box to form series of devices that communicate and work together to operate microscope.
- Constructed support table, custom Faraday cage with vibrational dampening and sound absorbing panels allowing measurement of picoamp currents in nanometric regions
- Generated engineering drawings for all the designed parts.

Conclusions

- An electrochemical microscope was built that measures the electrochemical properties of materials with nanoscale resolution.
- It was designed to be modular and flexible with custom part designs made open source.
- Understanding the electrochemical performance at the nanoscale could ultimately lead to the designing of better electrochemical materials (e.g., for batteries, fuel cells).



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REU Site: Tomorrow's Nanomanufacturing: Engineering with Science (TNEWS).