Fabrication and testing of 3D nanostructured electrodes for high-capacity Li ion batteries. Nanowire, battery

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The performance, cost, and safety of electrical energy storage technology (i.e., batteries and supercapacitors) are recognized at the Achilles' heel in our evolution towards an efficient and broad deployment of electrified transportation. Silicon nanostructures present one of the most attractive electrode materials for the next-generation of high-capacity lithium ion batteries. The high charge capacity of a lithiated silicon anode exceeds that of conventional graphite electrodes by almost tenfold; this property has been exploited to fabricate nanostructured silicon anodes for next-generation nanostructures in lithium ion batteries. A critical roadblock to successfully advance and deploy nanostructures battery technologies is the need for scalable fabrication methods. This project builds on recent advances in creating mesoporus metal nanofiber films (Joo) and the growth of silicon and germanium nanowires directly on metal surfaces without the need for expensive vacuum processing or nanopatterning (Hanrath). This approach enables high-throughput fabrication in a roll-to-roll configuration. Beyond the growth on bulk metal films, we see exciting prospects to grown nanowires on mesoporous metal foams. The anticipated resulting mesoporous hierarchical structures are attractive platform for 3D electrodes combining high-capacity and fast charge/discharge performance. The student involved in this project will establish fundamental processing-structure-performance relationships of the 3D structures electrodes by fabricating nanostructured electrodes, characterizing the structure and analyzing electrochemical performance.