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Silicon Nanowire Anodes: Materials and Composites

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Silicon nanowires (SiNWs) have the potential to perform as anodes for lithium-ion batteries with a much higher energy density than graphite. Previously, we have shown that reversible capacities >3,000 mAh/g can be obtained by using an electrode geometry consisting of SiNWs grown on metallic current collector substrates using the CVD-based vapor-liquid-solid (VLS) method. These electrodes consisted of SiNWs directly attached and vertically oriented off of the current collector. SiNWs can be synthesized in large quantities using the supercritical-fluid-solid (SFLS) method. Slurries were prepared composed of silicon nanowires synthesized using the SFLS method mixed with amorphous carbon or carbon anotubes and binder and coated onto Cu foil. Recent results regarding the cycling behavior of the SiNWs using different experimental conditions will be presented. The performance of these composite electrodes will also be compared with our previous work using the VLS SiNWs to determine how the electrode architecture affects the electrochemical performance.