

## ***Bioenergy 2020: Prelithiated Si nanoparticles-carbon nanotubes composite anodes for high performance of Li-ion batteries***

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Freestanding flexible Si nanoparticles-multi-walled carbon nanotubes (SiNPs-MWNTs) composite paper anodes for Li-ion batteries (LIBs) are prepared employing a combination of ultrasonication and pressure filtration. No conductive additive, binder or metal current collector is employed. The SiNPs-MWNTs composite electrode material achieves first cycle specific discharge and charge capacities of 2298 and 1492 mAh/g, respectively. To deal with the primary cycle irreversibility, stabilized Li metal powder (SLMP) has been utilized to pre-lithiate the composite anodes. As a result, the primary cycle irreversible capacity loss is reduced from 806 to twenty-eight mAh/g and therefore the first cycle coulombic efficiency is increased from 65% to 98%. The connection between different SLMP loadings and cell performance has been established to know the pre-lithiation process of SLMP

and to optimize the development of Si-based cells. A cell containing the pre-lithiated anode is in a position to deliver charge capacity over 800 mAh/g without undergoing the initial discharge process, which enables the exploration of novel cathode materials.

It was also acknowledged the SiNPs-MWNTs electrode with 3:2 Si/MWNT ratio exhibits the optimal balance between the high capacity of SiNPs and therefore the high electrical conductivity and structural stabilization quality of MWNTs, resulting in a high rate capability, high specific capacity, and cycle life surpassing the traditional slurry-cast SiNPs electrode. The reversible capacity is 1866 mAh/g (based on the entire composite weight, an equivalent below) at current density of 100 mA/g. After 100 cycles, the electrode retains capacity of 1170 mAh/g at 100 mA/g and 750 mAh/g at 500 mA/g.