CONTROLLING THE LENGTH OF SINGLE WALL CARBON NANOTUBES BY ULTRASONIC CUTTING IN A PRAHINA SOLUTION.

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The physical and optoelectronic properties of single wall carbon nanotubes (SWNTs) make them ideal candidates to replace other forms of carbon in many power generation, energy conversion, and energy storage devices. The high electrical conductivity and surface area of cut SWNT electrodes could render them useful for proton exchange membrane fuel cell gas diffusion media or Li^+ batteries, by potentially improving Li intercalation and cycleability. SWNTs were synthesized using an Alexandrite laser vaporization process from Ni/Co doped graphite targets at 1150 ºC and 760 Torr. The as-produced SWNTs were purified by a nitric acid reflux and a thermal oxidation treatment (10 ºC /min ramp in a tube furnace, under flowing air, from room temperature to 530 ºC). Samples with varying SWNT length distributions were achieved through ultrasonication in a 4:1 %w/w sulfuric acid to hydrogen peroxide piranha solution for 2 hour, 4 hour, and 8 hour increments. Cut SWNTs were recovered as stand-alone electrode papers via vacuum filtration onto Teflon™ filter papers and then dried at 200 ºC for 1 hour. The resulting SWNT electrode material was characterized through atomic force microscopy (AFM), surface area analysis (e.g. BET), Raman spectroscopy, and UV-Vis-NIR spectroscopy. Length distribution of SWNTs was determined as a function of ultrasonic cutting time and was verified by the aforementioned characterization methods.