SWNT Enhancement of PEMFCs

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Proton exchange membrane fuel cells (PEMFCs) are being investigated as viable alternatives to fossil fuels. With water as its only byproduct PEMFCs are poised to become an essential component of a future hydrogen economy. PEMFCs consist of anode and cathode electrodes, anode and cathode catalyst containing membranes, and a proton exchange membrane (PEM). The function of the PEM is to prevent the flow of electrons across the cell while allowing the passage of ions. The performance of PEMFCs is dependent on the ability of the catalyst, typically Pt, to oxidize hydrogen in the anode and reduce oxygen in the cathode. The electrons produced through this process flow from one side of the cell to the other through an external load. As an alternative to conventional Pt support materials, single wall carbon nanotube (SWNT) soot containing Pt has been synthesized using a laser vaporization process with a modified graphite target. The resulting platinum-enriched raw soot has been characterized by thermo gravimetric analysis (TGA), UV-VIS-NIR spectroscopy, scanning electron microscopy (SEM), and electron dispersive x-ray spectroscopy (EDS). Fuel cell membranes were fabricated from platinum containing SWNT soot and a 5% w/w Nafion solution. The membranes were tested as both the anode and cathode against a commercial membrane resulting in a functioning fuel cell with open circuit voltages as high as 0.850V. A comparison is made with membranes fabricated with conventional platinum support materials.