University of Hawai`i at Mānoa

Hawai`i Natural Energy Institute

School of Ocean & Earth Science & Technology

Three Dimensional Chitosan Carbon Nonotube Composite Material for Biofuel Cell Applications

Multi-walled carbon nanotubes (MWCNTs) have been used as doping material for three dimensional chitosan scaffolds to develop a highly conductive, porous and biocompatible composite material. The porous and interconnected structures were formed by the process of thermally induced phase separation (TIPS) followed by freeze drying applied to aqueous solution of 1 wt% chitosan acetic acid. The porosity was characterized to be 97% by both mercury intrusion porosimetry measurements and by SEM image analysis. When MWCNTs were used as a filler to introduce conductive pathways throughout the chitosan skeleton, the solubilizing hydrophobic and hydrophilic properties of chitosan established stable polymer/MWCNT solutions that yielded a homogenous distribution of nanotubes throughout the final composite matrix. A percolation theory threshold of about 2.5 wt% MWCNTs was determined by measurement of the conductivity as a function of chitosan–to–MWCNT ratios. The powder resistivity of completely compressed scaffolds was also measured and found to be similar for all MWCNT concentrations (0.7 Ω cm to 0.15 Ω cm powder resistivity for MWCNTs of 0.8 wt% to 5 wt%), and almost five decades lower than the 20 kΩ cm found for pure chitosan scaffolds

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