High Hydrogen Content Nanostructured Polymer Radiation Protection System

PI: Alex Ignatiev
Center for Advanced Materials
University of Houston

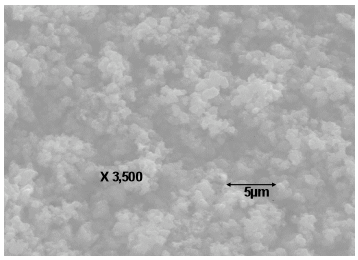
Collaborators:
Larry Pinsky, University of Houston
Steven Koontz, NASA-JSC

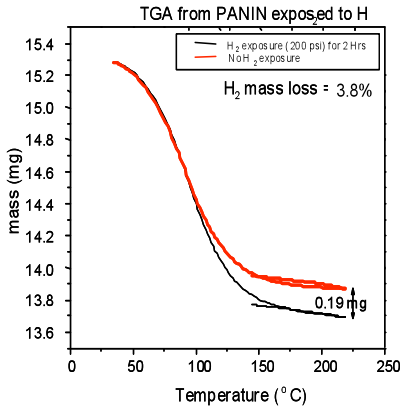
Program Objectives

A new radiation protection system is to be developed based on the unique hydrogen uptake properties of nanostructured polyaniline (PANI) polymers. The hydrogen-loaded nanostructured PANI is projected to exhibit more than 15 wt% total hydrogen with the additional benefit of electrical conductivity, thereby enabling a new space radiation protection scenario incorporating both passive (high hydrogen) and low Z active (electromagnetic shielding) in a single radiation hazard reduction building block.

Program Description

Polyaniline (PANI) powder will be specifically processed to yield samples with both nanoparticle and nanotube structures. Such samples have preliminarily shown the ability to absorb/adsorb significant additional hydrogen, and will be investigated for hydrogen loading at the > 15 wt% total hydrogen content. These samples will also be uniquely highly electrically conducting. The research effort will study the unique hydrogen uptake properties of PANI, will test the thermal, radiation exposure, mechanical and vacuum stability of PANI, and will apply Monte Carlos calculations to evaluate the radiation protection aspects of hydrogen-loaded PANI.





a. b.

Figure 1. a.) SEM micrograph of nanostructured PANI; b.) preliminary thermogravimetric data on hydrogen uptake n PANI at the 3.8 wt% level

Program Impact

The existence of a multifunctional high hydrogen content polymeric material that can be molded and shaped to fit a variety of space structures, and having the added benefit of conductivity can result in exemplary radiation protection scenarios for NASA's human space flight requirements. The high hydrogen content polyaniline proposed to be developed here will not only provide for exceptional passive radiation protection, but because of its conducting properties can be integrated into active radiation shielding concepts resulting in an unparalleled radiation protection system for integration into space suits, spacecraft, and space habitats.