

Results of Simulated Galactic Cosmic Radiation (GCR) and Solar Particle Events (SPE) on Spectra Restraint Fabric (Peters, Hussein, Waller)

Spectra or similar Ultra-high-molecular-weight polyethylene (UHMWPE) fabric is the likely choice for future structural space suit restraint materials due to its high strength-to-weight ratio, abrasion resistance, and dimensional stability. During long duration space missions, space suits will be subjected to significant amounts of high-energy radiation from several different sources. To insure that pressure garment designs properly account for effects of radiation, it is important to characterize the mechanical changes to structural materials after they have been irradiated. White Sands Test Facility (WSFTF) collaborated with the Crew and Thermal Systems Division at the Johnson Space Center (JSC) to irradiate and test various space suit materials by examining their tensile properties through blunt probe puncture testing and single fiber tensile testing after the materials had been dosed at various levels of simulated GCR and SPE Iron and Proton beams at Brookhaven National Laboratories. The dosages were chosen based on a simulation developed by the Structural Engineering Division at JSC for the expected radiation dosages seen by space suit softgoods seen on a Mars reference mission. Spectra fabric tested in the effort saw equivalent dosages at 2x, 10x, and 20x the predicted dose as well as a simulated 50 year exposure to examine the range of effects on the material and examine whether any degradation due to GCR would be present if the suit softgoods were stored in deep space for a long period of time. This paper presents the results of this work and outlines the impact on space suit pressure garment design for long duration deep space missions.