Testing of an Insulative Reusable Heat Shield Based on Novel Aerogel Blanket Technologies Through Physical Heat Exposure

Lee, Aaron (School: The Meadows School)

In a world with more cost-saving, reusable systems in the aerospace industry than ever before, heat shields remain a largely disposable system which, in their reusable form, lack the thermal performance necessary for capsules reentering the atmosphere further out from Earth. This project seeks to investigate the use of aerogel blankets as a backing for highly-emissive ceramic tiles to improve the insulative properties of the TUFROC reusable heat shield system. Using a type K thermocouple, high-temperature bunsen burner, aerogel blanket squares, and a silicon-carbide tile, a simulation was set up where a thermocouple measured the temperature of the aerogel blanket facing away from the tile receiving heat from a high-temperature bunsen burner. Given an 8-minute period of heating at an average temperature of 896 ˚C, the peak temperature of the unexposed aerogel blanket was 62.2 ˚C, cooling to 25.4 ˚C over the course of a 40-minute cooling period. The capability of the aerogel blanket heat shield system presented here to block large amounts of heat from penetrating the opposite side of heating indicates potential in utilizing aerogel blankets over the industry standard for TUFROC insulative heat shield systems, silica blankets, and further experimentation of the system under more intense heating conditions could make space exploration to farther-removed locations more accessible for a greater number of people and countries.

Awards Won:

Fourth Award of $500