Cryothermal Measurements of Variable Emittance Coatings with Varied Amounts of Tungsten Doping

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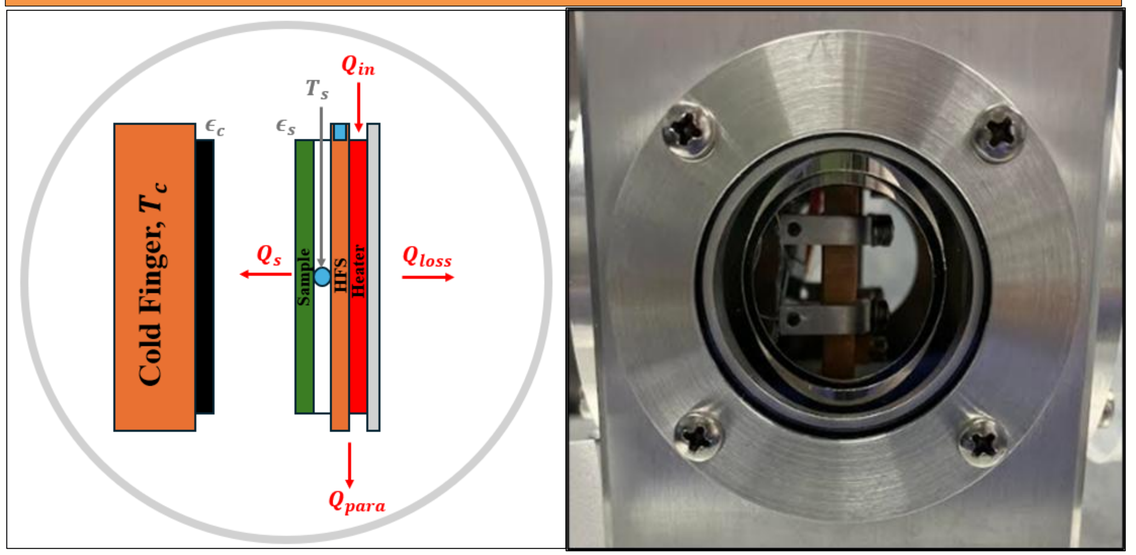
Abstract

The purpose of this experiment is to determine how tungsten doping with lower phase transition temperature ranges affects a variable emittance coating's performance in a cold space environment with internal heating. The results of this experiment will show how a variable emittance coating performs under cryostat testing conditions in order to determine its radiative cooling properties. By optimizing the performance of radiative cooling materials, energy originally used to provide thermal control can be preserved.

Sample Setup



Objectives

- Update experimental apparatus by replacing faulty sensors and redoing the sample mounting to improve the view factor, which was a source of error in past experiments
- Measure the emissivity of common materials for calibration purposes and comparison with VO2
- Test VO2 samples with different levels of doping in order to compare their performance and thermal properties

Results

Critical components, such as the heat flux sensor, patch heater, and thermistor were replaced. All internal wiring and sample mounting was redone in order to replace faulty sensors. Black Aktar, Tungsten mirror, and highly doped silicon (HDSi) were tested for calibration. 0% and 1% doped VO2 Fabry-Perot will be tested in the final weeks of the semester.

Future Work

The next steps are to test 1%, 2%, and 3% doped Silicon samples to show how the phase range temperatures change and determine how their emissivities vary with temperature.

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Experimental Setup

The cryostat replicates the environment of space, providing a high-vacuum, and cryogenic temperatures around 80K. The heater mimics internal heating from the spacecraft, and several sensors monitor the sample temperature as well as heat flux.