Simultaneous Microscale Optical Spectroscopy and Thermoreflectance Analysis

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Research question

What is the relationship between temperature-dependent spectral properties on the microscale?

Method

Combine setup of Microscale Optical Reflection and Transmission (MORT) that analyzes reflected lamp light over sample as a function of wavelength, and Thermoreflectance (TR) that analyzes reflected laser intensity to calculate sample temperature.

Experimental calculation

Temperature (TR):

$$k = \frac{V_{RT} - V_2}{V_{RT}(T_2 - T_{RT})}$$

$$\frac{\Delta R}{R} = \frac{1}{R}\frac{dR}{dT}\Delta T = k\Delta T$$

Spectrum (MORT):

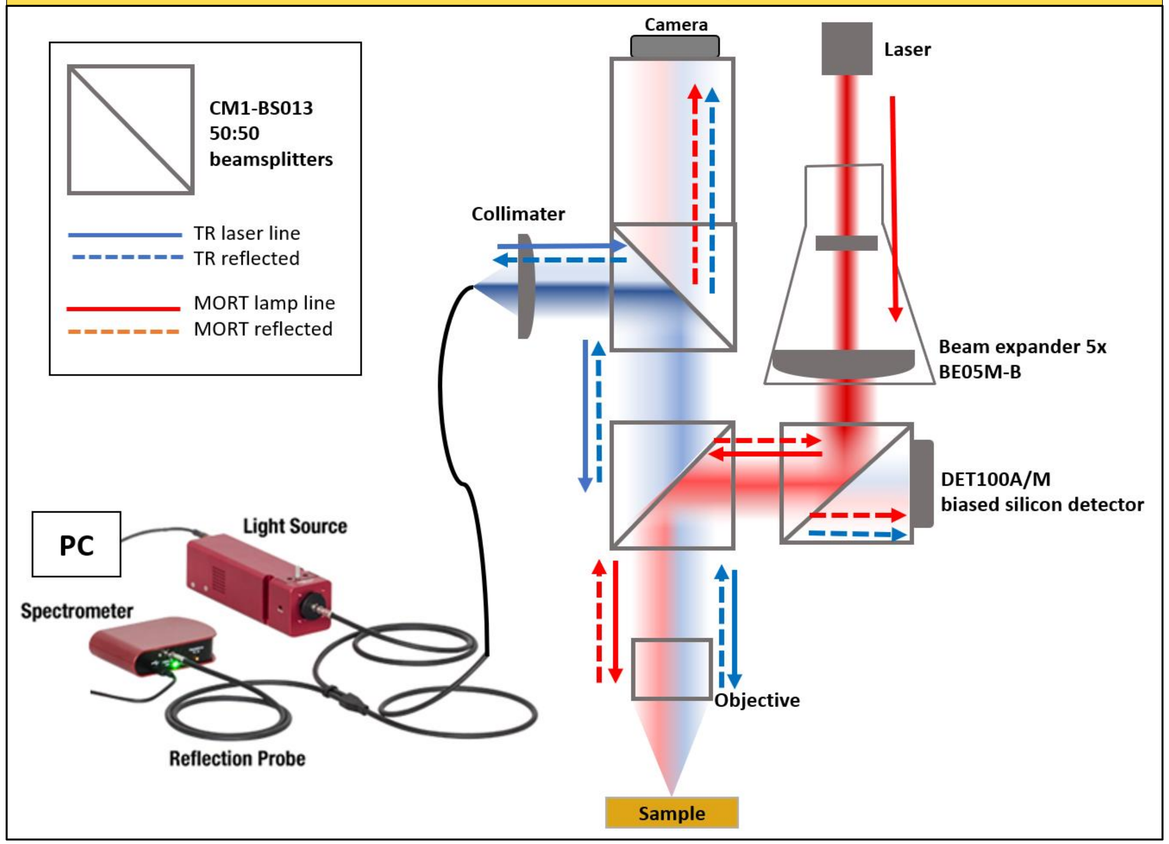
$$R_{sample} = I_{sample}/I_{Al} * R_{Al}$$

$$R_{Al} = \frac{(n-1)^2 + k^2}{(n+1)^2 + k^2}$$

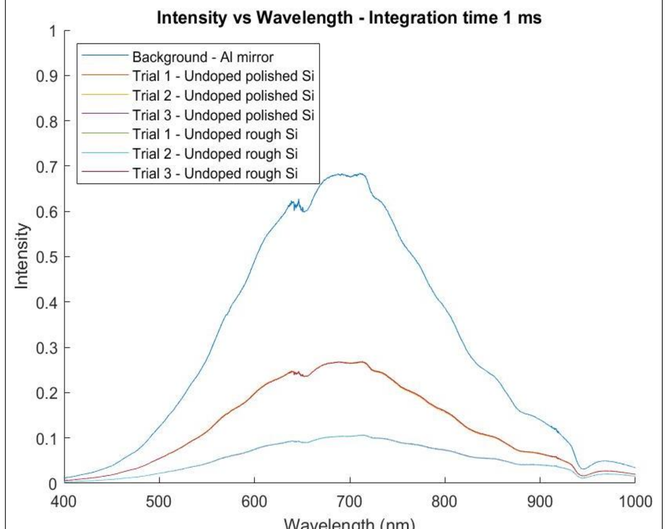
Impact

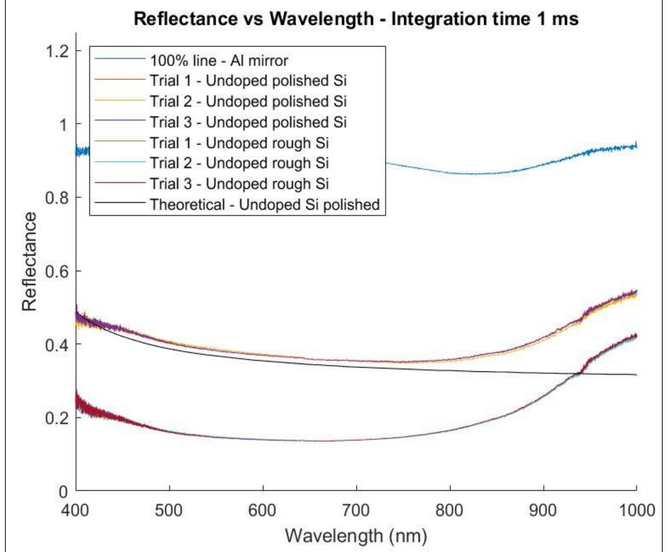
Previous research has been done with TR to analyze temperature on the microscale, however they have not studied its relationship to other properties. This will assist in understanding heat transfer related to optics, especially in understanding how the spectrum of light impacts the temperature of solar panels and therefore its efficiency.

Experimental setup



Results





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