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Thermal Conductivity and Specific Heat Measurements of Candidate Structural Materials for the JWST Optical Bench

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The James Webb Space Telescope will include an optical bench known as the integrated science instrument module (ISIM). Candidate structural materials for the ISIM must have low density, high stiffness, high thermal conductivity, and low thermal expansion coefficient at the operating temperature of 30 Kelvin. The specific heat is also important in modeling the on-orbit cooldown. We built two different systems for measuring the thermal conductivity and specific heat of samples between 4 Kelvin and 290 Kelvin. Both experiments were carefully designed to minimize potential errors due to radiative heat transfer. We chose the cooling system and instrumentation to allow long-term unattended operation. Software was developed to automate each experiment. It used an algorithm designed to ensure that each system was in thermal equilibrium before a measurement was taken. We describe the two experiments and present the data.

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