

Study on Thermal Insulation Based on Polyimide Foam for Future Spacecrafts

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For thermal design of spacecraft, the heat insulator that has a superior insulation efficiency and the examination of the system design are required. And, it is important to measure the thermal conductivity, the thermal diffusivity, and the specific heat to evaluate the insulation efficiency under atmospheric and vacuum condition in low and high temperature range. We propose new polyimide foam as the thermal insulation material for spacecraft thermal design. This material has characteristics of high heat resistance, high ultraviolet resistance, electrical insulation, and lightweight.

In this paper describes a thermal diffusivity measuring device and measurement result of the density dependence and the temperature dependence of thermal diffusivity for polyimide foam under atmospheric pressure. The measurement of the thermal diffusivity is based on the cyclic heat method. The measuring device consists of the control system, the measurement system and a vacuum chamber. The measurement system consists of a sample, a seat heater, a thermo-couple, and a sample holder. The control system is a function generator, a lock-in amplifier, a relay, a Data logger, DC power, and PC.

From the result obtains, the thermal diffusivity of the polyimide foam has small temperature dependency in a temperature range between 236 K and 359 K, and it has the thermal anisotropy with the high density.