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C2Or2B-04: Experimental investigation on combination of vapor cooled shield (VCS) and multilayer insulation (MLI) for cryogenic application

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The long-term storage of cryogenic propellants on orbit under thermal and pressure control is a promising enabling technology for future space exploration. The combination of vapor cooled shield (VCS) and multilayer insulation (MLI) is considered as an effective passive thermal control method for such missions. To verify the modeling results on the thermal insulation performance by introducing VCS, a cryogen boil-off calorimeter system has been designed and fabricated. It is capable of measuring the heat flux through the VCS, as well as the temperature profiles both on the VCS and inside the MLI. The insulation effectiveness of VCS will be evaluated with liquid nitrogen as the simulated cryogen in the warm-boundary temperature range from 120 K to 360 K, for the cases with or without VCS. In addition, the heat transfer behavior within the insulation combination will be discussed in detail.

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