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Thermal Performance Testing of Cryogenic Multilayer Insulation with Silk Net Spacers

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Early comprehensive testing of cryogenic multilayer insulation (MLI) focused on the use of silk netting as a spacer material. Silk netting was used for multiple test campaigns designed to provide baseline thermal performance estimates for cryogenic insulation systems. As more focus was put on larger systems, the cost of silk netting became a deterrent and most aerospace insulation firms began using Dacron (or polyester) netting spacer material by the early 1970s. In the midst of the switch from silk netting there was no attempt to understand the difference between silk and polyester netting, though it was widely believed that the silk netting provided slightly better performance. Without any better reference for thermal performance data, the silk netting performance correlations continued to be used. In order to quantify the difference between the silk netting and polyester netting, a brief test program was developed. Silk netting was obtained from the remnants of legacy flight programs and was tested on the Cryostat-100 boil-off calorimeter in three different configurations. The data shows good agreement with the historical silk netting based correlations and indicates a performance improvement when compared to previous testing performed using polyester netting and aluminum foil/microfiberglass paper MLI systems. Additionally, the data further reinforce a recently observed trend that the heat flux is not directly proportional to the number of layers installed on an MLI system.

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