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(Prof. Vidal Ledner)

A HEAT TRANSFER INVESTIGATION OF LIQUID AND TWO-PHASE METHANE (PAPERBACK)

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Bibliogov, United States, 2013. Paperback. Condition: New. Language: English . Brand New Book ***** Print on Demand *****.A heat transfer investigation was conducted for liquid and two-phase methane. The tests were conducted at the NASA Glenn Research Center Heated Tube Facility (HTF) using resistively heated tube sections to simulate conditions encountered in regeneratively cooled rocket engines. This testing is part of NASA's Propulsion and Cryogenics Advanced Development (PCAD) project. Nontoxic propellants, such as liquid oxygen/liquid methane (LO₂/LCH₄), offer potential benefits in both performance and safety over equivalently sized hypergolic propulsion systems in spacecraft applications. Regeneratively cooled thrust chambers are one solution for high performance, robust LO₂/LCH₄ engines, but cooling data on methane is limited. Several test runs were conducted using three different diameter Inconel 600 tubes, with nominal inner diameters of 0.0225-, 0.054-, and 0.075-in. The mass flow rate was varied from 0.005 to 0.07 lbm/sec. As the current focus of the PCAD project is on pressure fed engines for LO₂/LCH₄, the average test section outlet pressures were targeted to be 200 psia or 500 psia. The heat flux was incrementally increased for each test condition while the test section wall temperatures were monitored. A maximum average heat flux of 6.2 Btu/in.² sec was achieved and, at times, the temperatures of the test sections reached in excess of 1800 R. The primary objective of the tests was to produce heat transfer correlations for methane in the liquid and two-phase regime. For two-phase flow testing, the critical heat flux values were determined where the fluid transitions from nucleate boiling to film boiling. A secondary goal of the testing was to measure system pressure drops in the two-phase regime.

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