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NASA TECH BRIEF

Lewis Research Center

Survey of Heat Transfer to Near Critical Fluids

A survey and analysis was conducted on heat transfer to fluids in near critical conditions. The topics covered include the following: heat transfer boundaries of the near critical region; free, natural, and forced convection experiments; oscillations; geometric effects; parameters which appear to be significant to heat transfer in the critical region; and theories which have been proposed for the region. Although the state-of-the-art is such that completely satisfactory theories or correlations are not available for heat transfer in the critical region, this survey indicates the most promising and widely used correlations and suggests procedures for approaching a critical point heat transfer problem. The survey brings together information on the near critical region, examines these data from a designer's point of view, and examines the flow mechanisms underlying the behavior.

Transport processes, particularly heat transfer, in the near critical region have been of interest for approximately 15 years. Current interest stems from applications which require the use of a fluid in the near critical condition, from information that is too incomplete to produce satisfactory design expressions, and from an inadequate understanding of the mechanics which produce the peculiar behavior in the near critical region.

Current or proposed applications include the use of near critical helium to cool the coils of superconducting electromagnets and superconducting electronic or power-transmission equipment, the use of supercritical hydrogen as a working fluid or fuel for both chemical and nuclear rockets, the use of supercritical water in electricity generating plants, and the use of methane as a coolant and fuel for supersonic aircraft.

Theoretical heat-transfer analyses have not, in general, been successful; however, this approach still shows promise for solving questions relating to the near critical region. By contrast, flow oscillations characteristic of this region have been examined analytically and found to be reasonably well predicted by using rather conventional concepts in mechanics.

Notes:

1. The following documentation may be obtained from:

   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   Reference:
   NASA-TN-D-5886 (N71-13035), Survey of Heat Transfer to Near Critical Fluids

2. Technical questions may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B71-10262

Patent status:

No patent action is contemplated by NASA.

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