NASA TECH BRIEF

Technique for Measuring Absorptance and Emittance by Using Cyclic Incident Radiation

A new technique has been developed for determining absorptance and emittance of metal surfaces by the use of cyclic radiation. The proposed method is based on the use of a strip of metal placed in a vacuum environment such that no convection heat transfer occurs. The strip is exposed to simulated solar radiation and is supported at both ends. Each end is held to the same constant temperature by a heat sink, whose temperature can be controlled to heat or cool the strip. With steady-state conditions established to yield an isothermal test area (the strip midpoint), the incident radiation is varied in a periodic fashion.

This measuring technique has several desirable characteristics and is capable of yielding absorptance α and total hemispherical emittance ϵ over a wide range of temperatures. The desirable features exhibited by the proposed experimental method are:

(1) α, ϵ, and α/ϵ can be determined independently and simultaneously from one set of data.

(2) By proper selection of cooling, sample geometry, and radiation intensity, a range of sample temperatures can be provided.

(3) The measurement accuracy is promising.

Two experiments have verified the concept.

Notes:

1. These investigations were conducted in the NASA-Lewis pilot solar simulator facility at space conditions (a pressure of 10^{-12} torr and a background temperature of 4.2°K) on a 2-mil thick, pure copper sample and a 1-mil thick 304 stainless steel sample at temperatures of 327°K and 274°K respectively.
2. Metals, such as stainless steel and aluminum, are being investigated for temperatures ranging from 100° to 400°K.
3. Additional details are contained in NASA Technical Memorandum X-52193 "Technique for Measuring Absorptance and Emittance by Using Cyclic Incident Radiation," by John R. Jack, Lewis Research Center.
4. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 23365
   Reference: B66-10630

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: John R. Jack

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Category 02