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NASA TECH BRIEF

A Stabilized Low-Frequency Alternating-Current Electric Arc

The problem:

To achieve stable operation of a low-frequency (12 to 22 Hz) ac electric arc.

The solution:

Establish an arc between water-cooled tungsten-tipped electrodes, maintain the arc along the centerline of a central jet of argon gas, and surround the argon jet with a coaxial sheath of nitrogen.

How it's done:

Water-cooled copper electrodes were equipped with tungsten tips. In operation, the tips are at sufficiently high temperatures to melt the ends and ensure adequate thermal electron emission for reignition as the arc current passes through zero. This contributes significantly to arc stability. Argon was chosen as the central jet gas because it is relatively easy to ionize and produces a highly radiant plasma. An outer sheath of nitrogen surrounds the argon jet to provide further stabilization.

A low-frequency ac arc of this design was built and operated at arc frequencies from 12 to 22 Hz. The outer gas sheath velocity was varied from zero up to a value greater than that of the inner gas jet. Arc behavior was quite insensitive to changes in velocity of either the inner or outer gas streams. The arc column diameter did not change with increasing flow rate of either of the two coflowing gases. (A "thermal pinch" effect normally occurs as the external cooling of the gas jets decreases the column diameter and increases the plasma intensity.) Helium was also used as the sheath gas, but with helium, the arc was quite unstable and arc startup was difficult.

Notes:

1. The experimental arc facility of this investigation is considered to be a useful tool for the study of radiant heat transfer processes at high temperatures.
2. The following documentation may be obtained from:

   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.65)

   Reference: NASA TM-X-52424(N68-21242), Coaxial-Flow Stabilization of an Alternating-Current Plasma Arc
3. Technical questions may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B70-10065

Patent status:

No patent action is contemplated by NASA.

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(LEW-10442)

Category 01