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Brief 66-10435

NASA TECH BRIEF

Chemical Regeneration of Emitter Surface Increases Thermionic Diode Life

The problem:

Increasing the operating efficiency and extending the life of thermionic diodes. Thermionic diodes produce electrical power directly from heat energy by thermionic emission. The diodes' operating efficiency increases with the operating temperature of the emitter electrode. At high operating temperatures, however, sublimation of the emitter material can destroy the structural integrity of the emitter and collector surfaces or cause a short between these surfaces.

The solution:

Regeneration of the emitter electrode by chemical transport reactions. A gas that will form chemical compounds with the sublimated emitter material is introduced into the space between the emitter and the collector. The compounds migrate to the emitter where they decompose and redeposit the emitter material.

How it's done:

Experimentation using a simulated thermionic diode, incorporating a tungsten emitter and a tungsten collector, with chlorine gas introduced as the chemical transporting agent, has shown that emitter regeneration occurs at chlorine partial pressures of 10^{-4} torr and higher, and at emitter temperatures of 2170^{o} to 2550^{o}K and collector temperatures of 1460^{o} to 1730^{o}K. These results indicate that the regenerative process is applicable over the range of pressures and temperatures generally encountered in thermionic diodes.

Notes:

1. Although regeneration of hot metallic surfaces by chemical transport has been used to extend the life of incandescent and photoflood lamps, the process has not previously been applied to thermionic diodes.
2. Further information concerning this innovation is given in NASA TN D-1877, "Experimental Investigation of Chemical Regeneration of Surfaces in Simulated Thermionic Diodes" by Helmut F. Butze and Arthur L. Smith, July 1963, available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151. Inquiries may also be directed to:

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Patent status:

No patent action is contemplated by NASA.

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