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AEC-NASA TECH BRIEF

Studies of Cycles for Liquid-Metal Magnetohydrodynamic Generation of Power

Extensive studies of liquid-metal magnetohydrodynamic (MHD) power cycles have shown their potential to be excellent; the results (*1*) indicate that the overall efficiency of a binary cycle, employing a liquid-metal topping cycle and a bottoming steam cycle, may reach 60%. Details of analyses and data on cycles are presented, and the commercial potential of the binary cycle is discussed.

On the basis of recent developments in reactor technology and magnetohydrodynamics, a power system is evolving that appears to have good potential for both commerce and space. The concept involves the coupling of a reactor to a liquid-metal MHD generator, with liquid metal acting as both the cooling medium and the working fluid.

Recent advances in magnetohydrodynamics indicate the feasibility of direct conversion of heat into electricity. The liquid-metal MHD cycle, like the plasma MHD cycle, still has many problems to overcome, but its power density is about an order of magnitude greater than can be achieved with the plasma generator. The liquid-metal MHD cycle has essentially no moving or rotating components, an important factor in long-lived systems. Moreover the liquid-metal cycle requires no pumps or compressors that rob the cycle of very substantial amounts of power.

Three basic cycles have been proposed for a liquid-metal MHD power system: (i) the two-component, two-phase cycle; (ii) the condensing cycle; and (iii) the one-component, two-phase cycle. These cycles are fundamentally similar in that they are based on the conversion of thermal energy into kinetic energy, or stagnation head, which is then converted into electrical energy by an MHD device; they differ primarily in the manner of conversion of the thermal energy.

The potential of the liquid-metal MHD concept was investigated by extensive analyses of these three cycles, leading to preliminary judgment on their relative merits when applied to commercial and space power systems.

Various working fluids such as mercury, mercury-potassium alloy, potassium, cesium, and sodium were investigated over wide parameter ranges that would be compatible with both commercial and space systems. Preliminary economic evaluations also were made.

Reference:

1. M. Petrick and Kung-yu Lee, *ANL-6954* (Argonne National Laboratory, Argonne, Ill., June 1965); available from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, at $3.00 (microfiche, $0.65).

Notes:

1. The information may interest the power-generation industry.
2. Inquiries may be directed to:

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(continued overleaf)

Patent status:

Inquiries concerning rights for commercial use of this innovation may be made to:

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