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NASA TECH BRIEF

Miniaturization of Magnetic Logic Circuitry

It has been demonstrated that special partial-set-state characteristics, present only in cores cut ultrasonically from larger toroids, are important to magnetic logic circuit operations. Not until the fabrication of integrated ferrite structures was it known that these characteristics could be produced by other means. With fabricated structures, the desired characteristics can be obtained in materials having a coercive force ranging from below 0.8 oersted to above 8.0 oersted. Ferrite structures offer a definite advance in that previous long path lengths used to control flux can now be replaced by a small size core having the necessary high coercive force. This development indicates the feasibility of making a structure that would functionally replace a logic circuit containing 80 toroidal cores. In addition to miniaturization of magnetic logic circuits, the development may also be useful in memory, inductor, permanent magnet and microwave applications and should be of particular interest to those concerned with the design and development of computer and microwave hardware.

Two ferrite materials, each having different formulation and magnetic characteristics, can be bonded into a continuous ferrite structure by preparing the materials as a slurry, and then using the doctor blade method to form flexible ferrite sheets. After firing, the sintering process was found to be continuous across the bond, and bi-material structures prepared by this method showed that each magnetic material retained its unique magnetic characteristics. Magnetic cores in sizes 300 mils, 130 mils and 70 mils, have been pressed and processed to have the same partial set-state threshold values.

Notes:

1. These bi-material structures have not been perfect; some have warped, most have had a shape distortion, and the magnetic characteristics of the low-coercive-force material need to be improved. However, the feasibility of making complex bi-material structures has been demonstrated, and corrections for the defects that persist are believed to be known.
2. Documentation is available from:

   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP 69-10148

Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457 (f)], to the Ampex Corporation, 401 Broadway, Redwood City, California 94063.

Source: P. D. Baba
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