

On the easy magnetization of metallic glasses.



Ribbons and wires made of ferrous metallic glasses can be fully magnetized by applied fields of less than one Oersted and demagnetized by fields of several milli-Oersteds. Indeed the earth's field can magnetize and demagnetize them. These METGLAS[™] materials are typically composed of 80% transition metals (Fe, Co, Ni, etc.) and 20% metalloids (P, B, Si, etc.). They are quenched very rapidly from the liquid state (rates of about 10^6 °K/sec) to retain the amorphous liquid structure.

Ribbons of one alloy show the following properties under moderate tensile stress: coercive force = 0.007 Oe; induction at 1 Oe = 7800G; maximum permeability = 10^6 ; loop squareness = 0.99. For other compositions, the saturation magnetization ranges from 8 to 15,000G. The electrical resistivities are about 3X larger than for crystalline Fe-Ni alloys.

These excellent properties are believed to result from the absence of grain boundaries which usually inhibit domain-wall motions and the absence of crystal anisotropy which usually inhibits domain rotations. Glasses in which magnetostriction is also absent should have nearly infinite permeabilities.

Unlike conventional soft magnetic materials, METGLAS alloys are extremely hard, strong and ductile. Therefore, their magnetic properties are much less sensitive to handling and are maintained after mechanical working.

Possible applications include: current and pulse transformers, magnetic amplifiers, switches and memories, recording heads, transducers, delay lines and magnetic shields.

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equations are a few samples of the breadth of example that Whitham includes. The book is a clear guide for self-study, but will be equally desirable as an advanced text.

The author is well qualified for his task having made numerous and various original contributions to the field over the past 25 years. He is currently professor of applied mathematics at the California Institute of Technology.

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Superconducting Machines and Devices: Large Systems Applications

S. Foner, B. B. Schwartz, eds.
692 pp. Plenum, New York, 1974. \$39.50

The editors are to be congratulated for their organization of this timely and successful summer institute and the subsequent publication of the proceedings. They chose a prestigious international advisory committee and, with this help, 23 of the more active and prominent people working in this area to deliver the lectures and prepare the written material. In most cases, the authors have pioneered in the exciting developments following the 1961 discovery of the high-field properties of niobium tin and contributed significantly to the many conferences and growing body of literature on this subject. Consequently the book is up to date and authoritative.

The work will be helpful to students in applied superconductivity and engineering, to serious workers in the field and to those scientists and engineers wishing to familiarize themselves with current progress in this technology. Another way to view this book is to consider it as a preview of some of the technologies that will develop and mature in the post-industrial societies of twenty to thirty years from now. It should also help to revitalize university courses in power engineering which have tended to become stale in past decades.

The energy crisis and the vast expenditures contemplated to meet future energy needs make power engineering, transportation and industrial growth, among the most challenging fields to which a growing number of advanced technologies will be applied. These include thermonuclear fusion, magnetohydrodynamics, rotating machine development, electrical-power transmission, instrumentation, computation and magnetically levitated ground transportation. The superconducting aspects of these technologies are treated in the present volume in addition to a neces-

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sary discussion on superconducting materials and relevant comments on research applications. In some cases the presentations overlap, but in my view, it is an advantage to obtain different points of view on the same problem. A minor point might be that the discussion on a hydrogen economy is out of place but it serves as a reminder that competing concepts do exist for most technologies.

The book contains accounts of development programs on large-scale applications of superconductivity in France, West Germany, Italy, Japan, Switzerland, Great Britain and the United States. While this 64-page review might date the work and some may feel it should have been a separate, paperback supplement it does serve to indicate the growing seriousness with which the industrial nations view the possible applications of superconductivity. I cannot escape the feeling that some of these expenditures are being made with a view to intense competition for future markets. This section may be particularly valuable to program administrators and those engaged in national planning who have yet to take account of the significance and rapid pace of these developments.

A minor criticism, which could be equally well applied to most other books and conferences on applied superconductivity, is that the question of helium availability is not raised. There is a conflict between spending large sums to develop helium based technologies and ignoring the problem of securing the necessary helium supply. Apart from the US, which has 42-billion cubic feet in storage and is currently dissipating all helium in natural gas to the atmosphere (about 9 billion cubic feet per year), no other country is bothering about securing a helium supply. We should either secure a helium supply for several decades of the next century or abandon these development expenditures.

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Metastable Liquids

V. P. Skripov
 272 pp. Halsted, New York, 1974. \$30.00

The nucleation and boiling of superheated liquids is again a subject of current interest both as a part of our deepening understanding of homogeneous nucleation and because of its technological significance. It has been repeatedly observed that when a cold liquid is poured onto a much hotter one, if their temperature difference falls into a well

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