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JODIE CHRISTNER, EDITOR

TECHNICAL COMMITTEES UPDATE: SOFT MAGNETIC MATERIALS

By R. Hasegawa

A summary of recent developments in bulk soft magnetic materials is given. Thin films and soft ferrites are not covered; they may be included more appropriately in reports on materials for magnetic recording, high frequency applications, etc.

[1] Amorphous Materials

The major area of application of amorphous metals is currently in utility distribution transformers. These energy-efficient devices exhibit core losses of about one quarter of those based on conventional silicon steel. The amorphous material for this application is based on $Fe_{80}(B,Si)_{20}$ and therefore its saturation induction (B_S) is about 1.6 T at room temperature. Although transformers' operating inductions have been reduced due to increasing cost of energy, larger B_s values are desirable from the standpoint of economic device design. Efforts to increase the saturation induction were made, but with little success. This is mainly because of the fact that the Fe moment increases but the Curie temperature decreases rapidly with increasing Fe content in the binary Fe-B metallic glasses. Furthermore, the crystallization temperature decreases with increasing Fe content.

Fujikura et al. (presented at the 8th Rapidly Quenched Materials Conf., Sendai, Japan; August, 1993 and also at SMM 11, Venice; September, 1993) report that a small amount of Sn (0.5 wt.%) tends to suppress surface crystallization which initiates bulk crystallization in high iron-containing Fe-B-Si metallic glasses. They further claim that these alloys have high saturation inductions and that Sn helps to reduce core loss. For example, $Fe_{83}B_{15}Si_2$ has B_s of about 1.67 T at room temperature and its core loss is reduced from 0.2 W/kg to 0.11 W/kg at 1.3 T/50 Hz when Sn content is about 0.3 wt.%. The Curie temperature was not reported, but is estimated to be about 350°C. This may force the operating flux density to a lower level, offsetting the advantage of the increased saturation induction.

To satisfy the market need for smaller magnetic devices, materials functional in the MHz region are increasingly in demand. Thin Co and Fe base ribbons (as thin as 5 μm) have been developed [Yagi et al., IEEE Trans. *MAG-26*, 1409 (1990); Choh et al., IEEE Trans. *MAG-28*, 2778 (1992)], showing core losses at 0.1 T/1 MHz of 1 and 4 W/cm^3, respectively. These values are compared with 2.5 and 2.8 W/cm^3 for MnZn ferrites and 5 μm thick supermalloy, respectively.

In the area of specialty applications of amorphous metals, an interesting discovery has been made. A giant magnetoresistance (of the order of 12%) has been observed in a Co base near-zero magnetostrictive wire [Mandel et al., Phys. Rev. B*47*, 14 233 (1993)]. This is related to the unique magnetic domain structure (magnetization lying parallel to the wire direction at the center and along the wire circumference near the wire surface) developed during wire formation. At the recent MMM Conference (Paper ER-25), Machado et al. reported a giant AC (1-100 kHz) magnetoresistance (as large as 27%) observed in a similar material in ribbon form. The origin of this phenomenon is not clear.

[2] Crystalline Materials

One of the recent advances made in silicon steel is the production of thin grain-oriented Si-Fe (10-100 μm) by cold rolling and subsequent tertiary recrystallization of conventional g.o. Si-Fe [Ishiyama et al., J. Appl. Phys. *70*, 6262 (1991)]. A recent study on the effect of grain size on the magnetic properties indicates that core loss can be minimized by selecting an optimum grain size for a given frequency and that the optimum grain size for the minimum core loss decreases with frequency. For example, the optimum grain size is 0.8 mm for a 35 μm thick material used at 50 Hz and its core loss is about 0.25 W/kg at 1.3 T (Kim et al., Paper CD-01, Intermag, 1993). This core loss is higher than that (0.1 W/kg at 1.3 T/50 Hz) of a 25 μm-thick Fe-based amorphous ribbon.

By rapid solidification, it has been found that 6.5 wt% Si-Fe can be made ductile. The attractiveness of this material is its near-zero magnetostriction, low crystalline anisotropy and high electrical resistivity (about 80 μΩ-cm). Grain-orientation, however, is difficult to control by post-fabrication treatments, although some success was reported [Honma et al., J. Appl. Phys. *70*, 6259 (1991)]. Use of a CVD method was reported at the SMM 11 Conference (Yamaji et al., Paper S2-18) to produce this material (thickness: 0.1-0.3 mm;

TECHNICAL COMMITTEE UPDATE *(Continued on page 2)*

TECHNICAL COMMITTEE UPDATE: Soft Magnetic Materials

(Continued from page 1)

width: up to 600 mm) commercially. This material, non-oriented, has improved bend ductility and workability as well as excellent high frequency properties. For example, a 0.1 mm wide material shows a core loss of 9.3 W/kg at 1.0 T/10 kHz and a bending radius of less than 2 mm.

Crystallization of amorphous Fe-B-Si alloys containing small amounts of Nb and Cu results in "nanocrystalline" materials with fine grains of the order of 10 nm in size. These materials show high frequency properties comparable to those of Co-base amorphous alloys. Low thermal stability and high brittleness of these materials, however, are blocking their applications. New additions to this class of material include bcc Fe-M-B (M=Zr, Hf or Nb) alloys with saturation inductions exceeding 1.5 T [Suzuki et al., J. Appl. Phys. *70*, 6241 (1991)]. For example, $Fe_{91}Zr_7B_2$ shows B_s = 1.7 T. This material's low magnetostriction and low coercivity (7 A/m) make it an attractive soft ferromagnet. A recent study indicates that this material shows an improved thermal stability due to the existence of boron (Suzuki et al., Paper 23C4-3, RQ8 Conf., Sendai, 1993).

In summary, most of the recent activities mentioned above are at their early stages and their commercial developments should be of help to advance the present state of the technology.

IEEE SECTIONS CONGRESS 1993

by H.S. Gill

I attended the IEEE Sections Congress held in San Juan, Puerto Rico from July 1-4, 1993. I represented the IEEE Santa Clara Valley Section and the IEEE Magnetics Society at this congress. At this congress, a workshop was held to better understand the interface between three IEEE entities, Society, Section, and Chapter. About 200 Section Chairmen/Society Presidents attended this workshop. The main purpose of the workshop was to outline issues/work items to enhance the interaction between the Section/Chapter/Society, the three important subunits of the IEEE organization. The participants put forth the following 10 work items/issues:

1. Lack of communications between the IEEE Sections/Societies.
2. The role of Regional Chapters Coordinators unclear.
3. Review the interface between chapters/sections/societies. Rewrite Bylaws if needed to enhance interaction between these entities.
4. Find out the best practices (What works?)
5. Provide funding to Sections from conferences.
6. Enlarge electronic mail.
7. Consider the interests of the individual member.
8. Checking accounts for chapters. Currently Sections maintain finances.
9. Provide distinguished lectures to chapters at the Society's expense.
10. Up to date listing of chapters/sections/society officers.

The entire Sections Congress identified 33 work items to improve the operations of the IEEE. The delegates at the conclusion of the congress ranked these 33 work items in order of importance. These work items along with their ranking will be presented to the IEEE President and Board of Directors for approval and implementation. Out of these 33 items, following list (along with rank) is related to Society/Chapter/Section interaction.

Item (Rank):

• Increase and improve technical societies' support to local chapters (and sections) through: 1) rebates granted through local technical activities, 2) support to distinguished lectures tours, and 3) educational material (video conferences, self study courses, etc.)
(Rank = 4)

• IEEE is directed to study ways to establish improved communication between/among IEEE entities (i.e. Sections, Chapters, Societies, Student Branches) and to improve the response to the entities' inquiries and needs.
(Rank = 13)

• There is a need for IEEE to establish better communications between Societies and Sections, and to remove all barriers preventing effective funding for Chapter activity.
(Rank = 17)

• EAB should develop a clearinghouse/sharing service to support local Section/Chapter with topics for workshops/seminars that can be developed, enhanced, and delivered electronically: on-line email access; continuous updating of topics (also include other money-making ideas)
(Rank = 15)

• That Society Conferences be required to budget at least five percent of conference surplus for local Section support.
(Rank = 12)

• Reinstate $300 Section rebate for sponsoring of a technical conference.
(Rank = 7)

• Request change in IEEE Bylaws to require technical societies/councils to officially invite Sections to be involved in the planning and organization of conferences as a condition of budget approval.
(Rank = 13)

• IEEE should be governed in a way that encourages Sections to allow Chapters to have independent treasuries and financial control in order to build multiyear stability and society support.
(Rank = 32)

• Without interdicting the primary obligation of the Chapter to the Section, a Chapter-Society communication protocol should be adopted that encourages a stronger awareness between entities: a 12-month activity plan, revenue generation, membership development, reporting, resource list, AdCom involvement, strategic planning, recognition and awards.
(Rank = 27)

• IEEE should develop a process (and interactive computer tools) for soliciting, collecting, evaluating, and reporting

information on members' opinions, satisfaction, and needs at all levels of the Institute (Chapter, Section, Society, Region, etc.) and for integrating the members' opinions into the planning, development, and conduct of IEEE programs, products, and services.
(Rank = 18)

Two items in the above list have the same ranking (13).

IEEE President Martha Sloan who spoke at the congress and other directors appear quite serious about implementing the recommendations of the Sections Congress. I am hoping actions are taken on these issues.

MMM '93

Session AC — Particulate Recording Media

By Chair M. P. Sharrock

This was a very lively session, which confirmed the continuing vitality of particulate magnetic recording media technology. Perhaps most interesting was the degree to which the physics of small magnetic particles continue to be actively investigated at a basic level. This is especially true with regard to switching mechanisms, time effects, and sources of anisotropy.

Two papers, by Doyle *et al.* of the Univ. of Alabama and Pennsylvania, presented results of experiments done with nanosecond-scale magnetic pulses, in an effort to understand the high-speed switching properties of particles. The first dealt with the effects of superimposing pulsed and constant fields, and the second with nonlinear effects (reptation) of successive short pulses.

Another paper from Alabama, by Yu *et al.*, presented results of FMR in barium ferrite tapes. Fitting of calculated results to experiment gives information about the damping constant, which is relevant to high-speed switching properties.

Chang and Yu, of IBM and the Univ. of Minnesota, reported further results in their study, by magnetic force microscopy, of magnetic switching in individual (isolated) barium ferrite particles. Both coherent and incoherent patterns of angular dependence of switching field were seen, with the difference inferred to be due to variation in particle size and dopant concentration.

Zhou *et al.*, of the Univ. of Manitoba and Lanzhou Univ., described Mössbauer measurements of doped barium ferrite, which were able to determine the site preference of cobalt and tin ions.

Sadamura *et al.* of Toda described the modification of barium ferrite particles by the addition of magnetite, in order to achieve higher magnetization. The resulting particles show magnetic coupling between the two phases, but also separate Curie points at higher magnetite levels.

Spada *et al.* of UCSD revisited the intriguing question of the reversible coercivity increase of oxide particles due to polyphosphate treatment. They showed that the effect occurs, producing increases of typically 400 Oe, in materials that are already enhanced by surface cobalt, as well as in undoped oxides.

Nikles *et al.* of the Univ. of Alabama also addressed the polyphosphate effect, showing that it does not occur with other related agents such as pyrophosphate and presenting direct evidence that the phenomenon is not due to magnetostriction.

Lin *et al.*, of the National Tsing Hua Univ. and the National Taiwan Univ. Taipei, described the industrially important process of modifying acicular iron particles (MP) with aluminum, for control of particle growth and other properties.

Arroyo *et al.* of the Univ. of Alabama discussed an electrochemical method for evaluating the effects of potential magnetic media constituents on the corrosion tendencies of iron, with intended applications to the stability of MP media.

Barrom *et al.* of the Univ. of Alabama described the successful preparation of magnetic tapes using waterborne particle dispersions; this is of interest because of the environmental advantages of eliminating organic solvents from the process.

A paper by Choi *et al.* of Carnegie Mellon Univ. described a rheo-optical method for studying particle orientation in suspensions; in the analysis the hydrodynamic field is represented by an equivalent magnetic field.

Deymier *et al.* of the Univ. of Arizona described simulations of the dynamics of particle dispersions. Pictures were shown of the time evolution of chains, pairs, and overall orientation. A video was also available for viewing after the session.

Coverdale *et al.* of Keele Univ. and the Univ. of Central Lancashire presented Monte-Carlo simulations of the microstructure in particulate magnetic dispersions; the advance over previous work was the inclusion, in addition to the formation of clusters, of the interactions between and motions of the clusters.

Session BR — New Instrumentation and Measurement Techniques

By Chair Philip Trouilloud

The session contained posters dealing with non-destructive testing, sensors, magnetic force microscopy and material characterization.

Hirama and co-workers from Hitachi and from Hosei University used the imbalance in 3 coils driven with polyphase alternating current to detect defects in pipes.

Another paper from Hosei University by Doi *et al.* discussed defect recognition by local magnetic field measurement.

Chen and Jiles of Iowa State University elaborated on the use of a probe head to evaluate the intrinsic magnetic properties of a sample. They addressed geometrical effects and how to deal with a non-uniform interaction between the probe head and the material under test.

Sadada and Koga of Kyushu University presented an improved version of a torque sensor. By positioning the primary and secondary coils at 90&degree. to each other, magnetoelastic changes in the shaft could be measured with higher sensitivity.

Perlov *et al.* of IMC Ltd, discussed the response of YIG films to external fields with application to a three-component field sensor. They gave demonstrations of the sensor in

SESSION BR *(Continued on page 4)*

SESSION BR *(Continued from page 3)*

operation with the magnitude and orientation of an external field displayed on a computer screen.

Gomez and co-workers at the University of Maryland, College Park explained how vectorial magnetic field maps can be derived from magnetic force microscopy experiments by varying the tip orientation.

Foss *et al.* from the University of Minnesota presented extensive experimentation in tip selection and preparation conditions for MFM.

Trouilloud *et al.* from IBM discussed ways to characterize materials in small magnetic devices at the wafer level using changes in magnetoresistance under gradient-fields.

Lee and co-workers from Jeonbuk National University and from Sookmyong Women's University measured the Young's modulus in thin films using a new experimental approach, based on the vibrating reed method.

Waldried, Wadewitz and Dewar of the University of North Dakota presented a new microwave transmission spectrometer in the 12.4 to 18GHz range with high sensitivity. They also discussed experimental artifacts that are associated with transmission measurements. Vasilyev from the Don State Technical University evaluated the dispersion of particle sizes in magnetic powders by measuring Barkhausen noise.

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The objective of the **IEEE Magnetics Society Newsletter** is to publicize activities, conferences, workshops and other information of interest to the Society membership and technical people in the general area of applied magnetics. Copy is solicited from the Magnetics Society membership, organizers of conferences, officers of the Society and local chapters and other individuals with relevant material. The Newsletter is published in January, April, July and October. Submission deadlines are December 1, March 1, June 1, and September 1, respectively.

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NEW MATERIAL PUSHES U.S. ONE STEP CLOSER TO HYDROGEN ECONOMY

Ames, Iowa — Researchers at the Department of Energy's (DOE) Ames Laboratory recently announced the discovery of an important new material for magnetic refrigeration, a technology that may one day make it possible to replace fossil fuels with more renewable liquid hydrogen fuels.

The new refrigeration material developed by the Lab is described in a paper published in the January 10 issue of Applied Physics Letters. The material will reduce the overall cost of magnetic refrigerators by an estimated 40 percent and increase the efficiency of the refrigerators.

For the cooling power that they deliver, magnetic refrigerators are about twenty times more compact than gas-based refrigerators; the technology also does not use environmentally harmful chlorofluorocarbons. Researchers nationwide are working to apply magnetic refrigerators in space exploration, medical imaging devices, food processing and the production of liquefied gases like hydrogen.

The new material's development was supervised by Karl Gschneidner, director of the Rare-earth Information Center at Iowa State University (ISU) and the Anson Marston distinguished professor in materials science and engineering. The material, a combination of the elements aluminum, dysprosium and erbium, was developed through funding from the DOE's Office of Basic Energy Sciences.

In a magnetic refrigerator, the new material will undergo rapid magnetization and demagnetization to manipulate heat. Gschneidner said the new material responds to this process 30 percent better than the material currently in use, a compound composed of the elements gadolinium and palladium.

"It's probably more significant than just that thirty percent, though," says Gschneidner. "What you need to make the refrigerator work is a superconducting solenoid or superconducting magnet. With our new material in place you can use a smaller superconducting solenoid to deliver the same cooling power. The superconducting solenoid is the biggest capital cost in the refrigerator, and you probably save more than thirty percent by going to a smaller superconducting solenoid."

The new refrigeration material also replaces the rare and expensive element palladium with the common and very inexpensive element aluminum.

"That's a reduction in the two biggest capital costs right there," says Gschneidner. "I would guess that the overall price of the refrigerator is probably going to be reduced by about forty percent."

As technical advances make the magnetic refrigeration process cheaper and more efficient, scientists believe it may become possible to liquefy hydrogen so easily that liquid hydrogen will compete with or even replace fossil fuels as a source of power.

Ames Laboratory, a member of Iowa State University's (ISU) Institute for Physical Research and Technology, is operated by ISU for the DOE. The Lab conducts research into various areas of national concern, including energy resources, high-speed computer design, environmental cleanup and restoration, and synthesis of new materials.

WORKSHOP AND SYMPOSIUM ON PERMANENT MAGNETS

The Rare-earth Information Center (RIC) is proud to announce the availability of the proceedings of both the *Twelfth International Workshop on Rare Earth Magnets and their Applications,* and the *Seventh International Symposium on Magnetic Anisotropy and Coercivity in Rare Earth Transition Metal Alloys,* which were held in Canberra, ACT, Australia, in July 1992. Because of a limited first printing of these two proceedings, RIC obtained permission from the Workshop/Symposium (Conference) Organizers to reprint a limited number of copies of each for distribution to persons (organizations) who were unable to attend the Workshop and/or Symposium. The reprinted edition is identical to the original edition, except that a slightly heavier grade of paper was used in the second printing. The proceedings are beautifully bound in two volumes with a full color reproduction of a Kerr domain pattern of a highly aligned $Pr_{15}Fe_{77}B_8$ sample for the cover of both volumes.

The cost of the two-volume set is $150.00 US, or $75.00 US for either volume alone. These costs include mailing in the USA at the "Library Materials" rate (delivery time: one to two weeks), or surface book rate elsewhere (delivery time: four weeks to four months). If faster delivery times are desired, use the following rates (the number in parenthesis is the additional mailing cost for one volume):

Canada (first class)	$15.00	(9.00)
Europe (airmail)	40.00	(25.00)
Australia and Japan (airmail)	55.00	(35.00)
South America (airmail)	25.00	(15.00)

To order send a check (payable to the RIC Newsletter Fund) or purchase order for the appropriate amount, including the extra shipping costs if rapid delivery is desired. The check should be made payable through a US bank in dollars; otherwise add an additional $25.00 (our bank processing cost). Please state whether you are ordering the complete two-volume set, or which one of the two individual volumes: the *Workshop* or the *Symposium.* The check or purchase order should be sent to the Rare-earth Information Center, Institute for Physical Research and Technology, Iowa State University, Ames, IA 50011-3020, USA (Phone: 515-294-2272; Fax: 515-294-3709).

MAGNETICS SOCIETY INFORMATION ON THE IEEE COMPUTER

By John Nyenhuis

It is now possible to get information about the Magnetics Society in electronic form from the IEEE Computer. At the present time, three files are available. The names of these files are as follows.

info.mag.achievement_nominations.94
info.mag. calll.joint94
info.mag.conference.calendar

We have endeavored to have the file names reflect the content as accurately as possible. The first file is a call for nominations for the 1994 Society Achievement Award, the second file is a call for papers and general information for the 1994 joint MMM/INTERMAG Conference and the last file is the conference calendar.

You can request one or more files from the IEEE fileserver using the following procedure:

1. Initiate an email message to fileserver@info.ieee.org.

2. Press return at the subject line. (The fileserver ignores the subject line.)

3. Starting at the first line of the message type the names of one or more files, one per line. Do not add blank lines before or after the lines containing the names of the files.

4. Send the message. In about one hour, if all goes well, you will receive copies of the files that you requested. If you receive no answer, then something has gone wrong.

Many other files are available from the IEEE. For example, type the following in the body of the message.

info.info
info.index

and you will receive two files. The file info.info provides information on how to use the IEEE Computer Services. The file info.index contains a listing of files which are available from the IEEE computer. New files from the Magnetics Society will be listed in info.index. The names of Magnetics Society files will always start with info.mag.
Please send email to nyenhuis@ecn.purdue.edu (John Nyenhuis) if you have questions or if you have Magnetics Society material that you would like posted on the IEEE computer.

DISTINGUISHED LECTURERS FOR 1994

The Magnetics Society has selected three outstanding individuals to be the Distinguished Lecturers for 1994. In order to arrange for a talk by them for a Magnetics Society Chapter contact them directly.

DR. JAMES M. DAUGHTON

Giant Magnetoresistance - Materials and Applications

Newly discovered Giant Magnetoresistive Ratio (GMR) materials have magnetoresistance of 6% to over 50% compared with 2% to 4% for permalloy. The magnetic and magnetoresistive properties of these materials offer substatial improvements in several application areas, including magnetic field sensors, read heads for tape and disk drives, and Magnetoresistive Random Access Memory (MRAM). An improved magnetic field sensor using GMR materials is being made commercially. Proposed configurations of GMR sensors for high density read heads are described. Magnetoresistive Random Access Memory (MRAM) cells using 50-250 nm lithographies are feasible for ultra-high density memory by using GMR materials. Additional devices using novel magneto-transport concepts will be described as time permits.

Biography: James M. Daughton is the president of Nonvolatile Electronics, Incorporated (NVE). Prior to founding NVE, Dr. Daughton spent over 15 years at Honeywell working in solid state research and development. His last position at Honeywell was Vice President of the Corporate Solid State Laboratory, where the Magnetoresistive Random Access Memory (MRAM) concept was invented and developed. Prior to that, he was Vice President of the Solid State Development Center where he managed integrated circuit and sensor research and product development.

Prior to joining Honeywell Inc. in 1973, Dr. Daughton worked for a brief period with Fabri-tek as director of solid state memory development. Before that, he spent 10 years at IBM in Yorktown Heights, NY, and Burlington, VT, where he was a senior engineer working on magnetic and semiconductor memory devices.

Dr. Daughton attended Grinnell College and received his BS, MS, and PhD degrees in EE in 1959, 1961, and 1963, respectively, from Iowa State University. Both his MS and PhD thesis work involved thin magnetic films. He is a member of the IEEE and the Magnetics Society. Dr. Daughton has published about twenty papers and has thirteen issued patents.

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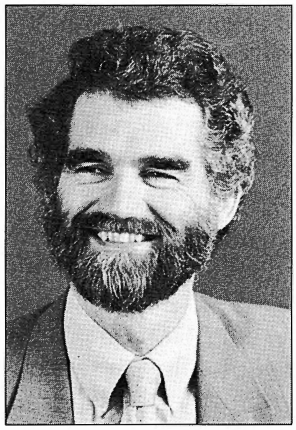

DR. ROGER WOOD

The Magnetic Recording Channel: Challenges and Directions

A revolution is occurring in magnetic recording technology. Innovations such as MR heads and PRML channels have caused a sudden upturn in the growth rate for areal density. Products at 1 Gbit/sq.in., packing an incredible 10 GBytes in a single 3.5″ disk drive seem to be just around the corner. Central to this revolution is our improved understanding of the read/write process and the ability to apply powerful readback detection algorithms. The presentation will include a personal view of some of the intriguing and challenging properties of the recording channel at very high densities & data-rates and will explore some of the exciting new signal detection options now being implemented.

Biography: Roger Wood is manager for Disk Drive Prototyping at the IBM Advanced Magnetic Recording Laboratory, San Jose, California. Since joining IBM in 1986 he has managed groups in magnetic integration and in channel development. Dr. Wood graduated from University College, London, in 1972 and, in 1979, received his Ph.D. in Electrical Engineering from the University of British Columbia. In 1979, he joined Ampex Corporation in Redwood City, California, where he conceived and directed the development of both the error correction system and the industry's first partial-response maximum-likelihood (PRML) detector for what has since become Ampex' most successful data acquisition recorder. Dr. Wood has authored some 30 technical papers and holds several patents on diverse topics ranging from channel coding to a new magnetic recording technique giving super-resolution.

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DR. ISAAK D. MAYERGOYZ

Mathematical Models of Hysteresis

The hysteresis phenomenon has been with us for ages and has been attracting the attention of many investigators for a long time. The reason is that hysteresis is ubiquitous. It is encountered in many different areas of science and technology. Examples include magnetic hysteresis, ferroelectric hysteresis, mechanical hysteresis, superconducting hysteresis, adsorption hysteresis, optical hysteresis, electron beam hysteresis, etc.

The talk is concerned with Preisach type models of hysteresis. It is emphasized that these models are phenomenological in nature and, for this reason, they can be used for the mathematical description of hysteresis of various physical origins. The discussion is centered around the following topics: various generalizations and extensions of the classical Preisach model (with special emphasis on vector generalizations), finding of necessary and sufficient conditions for the representation of actual hysteresis nonlinearities by various Preisach type models, solution of identification problems for these models, numerical implementation and experimental testing of Preisach type models. Although the discussion of Preisach type models constitutes the main theme of the talk, an effort is also made to establish some interesting connections between these models and such topics as the critical state model for superconducting hysteresis, the classic Stoner-Wohlfarth model for vector magnetic hysteresis, thermal activation type models for viscosity, magnetostrictive hysteresis and neural networks.

Biography: Isaak D. Mayergoyz was born in Kiev, U.S.S.R., on April 10, 1941. He received his Ph.D. degree in electrical engineering from the Institute of Cybernetics of the Ukranian Academy of Sciences, Kiev, in 1968.

He worked at the Institute of Cybernetics from 1966 to 1979 as a Senior Scientist. In 1980, he emigrated to the United States. Since 1981, he has been a Professor of Electrical Engineering at the University of Maryland, College Park. His research interests are in the areas of magnetic, computational electromagnetics, applied superconductivity, numerical modeling of semiconductor devices, power engineering, and applied mathematics.

Dr. Mayergoyz is a Fellow of IEEE, a Research Fellow of GE Corporate Research and Development (1988), a member of the Electromagnetic Society, and a recipient of the Outstanding Teaching Award of the College of Engineering, University of Maryland. Dr. Mayergoyz has published three scientific books and more than 150 scientific papers. He served for three years on the Edison Medal Committee, IEEE Award Board and on Program Committees of Intermag and MMM Conferences.

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SYMPOSIUM ON ELECTRONICS AND THE ENVIRONMENT

ISEE '94, International Symposium on Electronics and the Environment will be held May 2-4, 1994 in San Francisco, California. The conference is sponsored by the IEEE Technical Activities Board and its Design and Manufacturing Engineering Committee. Discussions will include all phases of life cycle from the initial design to the end of life refurbish and recycle efforts for electronic products. An exhibition and tutorial are part of the program. For information contact IEEE/ISEE Registrar, P.O. Box 1331, Piscataway, NJ 08855-1331; phone (908) 562-3878; Fax (908) 562-1571.

STUDENT TRAVEL ASSISTANCE FOR CEFC

A limited amount of funding has been made available by the Magnetics Society to provide partial assistance to students in order that they may attend the forthcoming Conference on Electromagnetic Field Computation (CEFC) in Aix-les-Bains, France on July 5-7, 1994. The funds are not intended to cover the full cost of attending the conference and the student must be nominated by a member of the IEEE Magnetics Society.

Nominations may be submitted to:

Prof. Jean-Claude Sabonnadiere, Chairman,
c/o CEFC'94 Secretariat,
LEG, ENSIEG, BP 46
38402 Saint Martin d'Heres Cedex,
FRANCE

IEEE-USA ELECTRONIC MAIL SERVICES AVAILABLE

IEEE-USA is continuing to expand its distribution of information by electronic mail. Eleven electronic "autoresponse" files have been established with Internet and Compmail addresses to provide information on subjects of interest to IEEE's U.S. members. In response to messages sent to these addresses, the corresponding IEEE-USA text file is sent automatically by e-mail. Currently available files and their addresses are described below.

IEEE-USA's electronic "autoresponse" files are just a few of the many information files being developed by IEEE as a member service. Instructions on how to use IEEE's electronic mail information resources can be obtained as an autoresponse file by e-mail message to ***info.info@ieee.org*** (Internet) or ***info.info*** (Compmail). For a complete listing of current files and their addresses, send an e-mail message to ***info.index@ieee.org*** (Internet) or ***info.index*** (Compmail).

Employment Assistance - U.S. members affected by the economic downturn and defense downsizing are looking increasingly to IEEE-USA for employment assistance. An electronic file is now available, which contains information about the various forms of employment assistance currently available, including commercial on-line job listings. Address: ***info.ieeeusa.employ@ieee.org*** (Internet) or ***info.ieeeusa.employ*** (Compmail).

Congressional Fellowships - Each year IEEE-USA selects two or three qualified members for a one-year Fellowship serving on the staff of a Member of Congress or congressional committee. Information on IEEE-USA's Congressional Fellowship program, including qualifications, application procedures, and a listing of past Fellows is available on-line. Address: ***info.ieeeusa.congfel@ieee.org*** (Internet) or ***info.ieeeusa.congfel*** (Compmail).

Federal Legislative Agenda - IEEE-USA prioritizes its public policy recommendations every two years in a Federal Legislative Agenda, which is submitted to Congress and the Administration. IEEE-USA's Federal Legislative Agenda for the 103rd Congress summarizes IEEE-USA recommendations in such key issue areas as U.S. competitiveness in global markets, retirement income policy, defense conversion, engineering careers, research and development, civilian space program, computers and communications, energy policy, and health care. Address: ***info.ieeeusa.agenda@ieee.org*** (Internet) or ***info.ieeeusa.agenda*** (Compmail).

Pensions Update - Pension reform is one of the key thrusts of IEEE-USA's Legislative Initiative. This file provides up-to-date information about pension portability and preservation of vested benefits, including the current status of legislation addressing the issue. Address: ***info.ieeeusa.pension@ieee.org*** (Internet) or ***info.ieeeusa.pension*** (Compmail).

Legislative Report Newsletter - Long-time Washington observer Edith Carper prepares a bimonthly IEEE-USA Legislative Report offering insights into current Congressional activities of interest to IEEE. Address: ***info.ieeeusa.legrpt@ieee.org*** (Internet) or ***info.ieeeusa.legrpt*** (Compmail).

IEEE-USA Position Statements - Recommendations on career and technology policy issues of concern to IEEE's U.S. members are recorded in position statements of IEEE's United States Activities Board. Current IEEE-USA positions are organized by topic area with information on how to obtain copies of specific statements. Address: ***info.ieeeusa.pos@ieee.org*** (Internet) or ***info.ieeeusa.pos*** (Compmail).

Influencing Public Policy - IEEE-USA has reissued a brief guide entitled "How to Communicate with Members of Congress," which offers useful tips to help IEEE members improve their ability to influence public policy on issues of concern. Address: ***info.ieeeusa.lobby@ieee.org*** (Internet) or ***info.ieeeusa.lobby*** (Compmail).

Washington Internships For Students Of Engineering - Each year IEEE sponsors two students for a ten-week summer internship in Washington, D.C., to study the interaction of science, engineering, and public policy. Information on the WISE program and application procedures are available on-line. Address: ***info.ieeeusa.wise@ieee.org*** (Internet) or ***info.ieeeusa.wise*** (Compmail).

Student Professional Awareness Conferences - With the support of IEEE's Regional Activities Board, IEEE-USA helps IEEE's Student Branches organize Student Professional Awareness Conferences (S-PACs), where student members are exposed to professional issues and concerns, such as career growth, professional ethics, self-management, engineers and public policy, and the role of the professional society. Information on S-PACs, what they are, how they're organized, and who to contact is available on line. Address: ***info.ieeeusa.spac@ieee.org*** (Internet).

Conferences - Announcements, advance programs, and registration information for pending IEEE-USA conferences, workshops, and symposia are now available on-line. Address: ***info.ieeeusa.conf@ieee.org*** (Internet) or ***info.ieeeusa.conf*** (Compmail).

Publications Of IEEE-USA - Each year IEEE-USA issues a number of useful publications, including the Employment Guide for Engineers and Scientists, the Salary and Fringe Benefit Survey, and various conference reports. Both free and sale titles are listed, along with ordering information. Address: ***info.ieeeusa.pubs@ieee.org*** (Internet) or ***info.ieeeusa.pubs*** (Compmail).

CURRENT E-MAIL SERVICES

File: info.email.services
Revision Date: June 29, 1993

IEEE e-mail services make use of several types of aliases. IEEE aliases are dummy addresses of the form "xxx.yyy@ieee.org". When a message arrives at the IEEE Internet node "ieee.org", the message is automatically forwarded to the appropriate mailbox - whether it be at the IEEE service center or around the other side of the world.

PERSONAL ALIASES - these are of the form "i.name@ieee.org" - IEEE members and volunteers can request a personal alias. There are three advantages to having such an alias:

1 - you will be listed in the IEEE E-mail Directory so that other people can find you,
2 - you have only one place to send future changes in your e-mail address,
3 - these aliases are usually much easier to remember and simpler to use than the real address.

STAFF ALIASES - many IEEE staff have e-mail addresses and aliases similar to IEEE volunteer aliases.

UNIT ALIASES - many IEEE Sections, 'Student Branches, and Societies have e-mail addresses and aliases of the form "unit.name@ieee.org"

INFORMATION ALIASES - these are of the form "info.topic@ieee.org" - over 70 auto-response text files are currently available. If an e-mail message (not really a message, but a request using a messaged format) is sent to an alias that begins with "info.", the message content is discarded, and a prewritten text file is automatically returned to the sender. These information text files are listed in an auto-response text file at "info.info@ieee.org".

These information files are also available via Anonymous-FTP from ftp.ieee.org [140.98.1.1] in the subdirectories under the /info directory. They are also NOW available via Gopher. If you have the Gopher client software, simply issue the command 'gopher@gopher.ieee.org'.

SERVICE ALIASES - these are of the form "service@ieee.org" - and enable you to request a service from IEEE. For example, send a message to "membership.inquiry@ieee.org" if you have a question about your IEEE membership - (i.e. your renewal cheque was cashed but IEEE sent you another bill!, or you want to apply to upgrade your membership from associate to full member grade, etc.). Currently there are over 20 service aliases available. These service aliases are listed in an auto-response text file at "info.services@ieee.org".

IEEE E-MAIL DIRECTORY AND FORWARDING SERVICE

To obtain a copy of any of the five IEEE E-mail directories, send a request (dummy message) to any of the following aliases. These are of the auto-response text file format described previously.

"directory.vols@ieee.org" a listing of IEEE volunteers
"directory.staff@ieee.org" a listing of IEEE staff
"directory.sec@ieee.org" a listing of IEEE sections
"directory.sb@ieee.org" a listing of IEEE branches
"directory.soc@ieee.org" a listing of IEEE societies

For information on how to obtain an IEEE E-mail alias, be included in the IEEE forwarding service, and be listed in the IEEE Volunteer Directory, send a request to "info.directory@ieee.org".

If you wish to have your Section, Student Branch, or Society listed, please obtain and read a copy of the text file available at "info.startup@ieee.org".

E-MAIL SERVICES CHANGES since November 24, 1992

"askieee@ieee.org" is a new email service for ordering any document or article. IEEE will locate it and deliver to you by mail or fax.

"info.new.technology" describes a new activity enabling members to participate in new technology developments within each of IEEE's technical societies.

FUTURE E-MAIL AND RELATED SERVICES

We expect to develop additional services which will be available by e-mail and related technologies. Your suggestions are welcome and should be sent to: "new.email.services@ieee.org".

For example; IEEE is working to provide bulletin board services at the local Section level; an "anonymous ftp" service is available at "ftp.ieee.org" (IP address is 140.98.1.1) from which all information text files can be copied; and various groups of members are implementing news groups.

New e-mail services and changes to existing e-mail services will be announced by updating the appropriate pre-written text files, such as at: "info.email.services@ieee.org".

URGENT REQUEST TO ALL FACULTY MEMBERS OF THE MAGNETICS SOCIETY

As some of you may remember, we had considerable communications problems in 1993 with regard to student travel support for attending INTERMAG 1993 in Stockholm.

If you expect to nominate a student for travel support now, or in the future, it is in your interest to "register" an e-mail address (your own, or a colleague's who will pass on messages to you) with me. I believe that virtually all institutions on all continents that are likely to have Magnetics Society members ELIGIBLE TO NOMINATE STUDENTS (nobody else, please) have e-mail capabilities. Please send me a short e-mail message with your name, institution, e-mail address (and, if you wish, fax and telephone number) OR name and e-mail address of contact, if you do not read e-mail. Also please tell me if you wish to keep this information confidential. Otherwise, we may include it in a future "Magnetics Society Faculty Address Book", or use it in a future news distribution scheme.

If you do not have any possibility of e-mail access at your institution (or one within a local telephone call), please fax the above information to me at +1 317 494-6440, substituting your fax number for an e-mail address. Remember that for most of us, the cost of e-mail is negligible compared to that of long-distance telephone service (fax).

Thank you,

F.J.Friedlaender, Chairman, Awards Department
fritzj@ecn.purdue.edu telephone: +1 317 494-4444, fax: +1 317 494-6440

RARE-EARTH MAGNETS WORKSHOP AND SYMPOSIUM

The University of Birmingham, UK will be host to the 13th International Workshop on Rare-Earth Magnets and Their Applications from September 11 to 14, 1994. This will be followed by the Eighth International Symposium on Magnetic Anisotropy and Coercivity in Rare Earth-Transition Metal Alloys on September 15, 1994.

Description of the Meeting

The Workshop and Symposium continues a series of biennial meetings initiated by Karl Strnat and designed for physicists, chemists, materials scientists, mechanical, chemical and electrical engineers working in the field of rare-earth-transition metal magnets and their applications. This is an area of rapid growth and those involved in all the various aspects of its development are warmly invited to attend the Thirteenth Workshop and Eighth Symposium in Birmingham. The Workshop will occupy three days and will concentrate on the processing, characterization and applications of rare earth magnets. The Symposium on Anisotropy and Coercivity will be held immediatly after the Workshop and will concentrate on the more fundamental aspects of the solid state physics and materials science of rare earth-transition metal alloys and magnets. The conference language will be English.

Topics covered by the Workshop include:

- Raw Materials, Resources and Processing
- Development and Characterization of RE-TM Alloys
- Processing of RE-TM Magnets
- Economic Aspects of Production
- Magnetic Circuit Design
- Corrosion and Corrosion Protection
- Electromechanical and Magnetomechanical Devices
- Device and Systems Engineering
- Magnetostrictive Materials and Devices
- Instrumentation, Standards and Test Methods

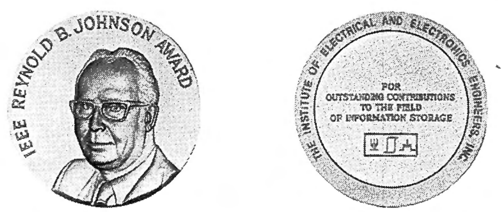
Topics covered by the Symposium include:

- New RE-TM Magnet Compositions
- Gas Phase Interstitial Modification
- Physics of Magnetic Anisotropy
- Magnetic Viscosity
- Observation and Modeling of Microstructures and Domains
- Nanocrystalline RE-TM Materials
- Coercivity Mechanisms

Further information may be optained by contacting:

I. R. Harris
School of Metallurgy and Materials
The University of Birmingham
Edgbaston
Birmingham B15 2TT, UK
TEL: (44) 21 414 5165, FAX: (44) 21 471 2207

IEEE REYNOLD B. JOHNSON INFORMATION STORAGE AWARD



The IEEE Reynold B. Johnson Information Storage Award was established by the Board of Directors in 1991 and may be presented annually "for outstanding contributions to the field of information storage, with emphasis in the area of computer storage." Recipient selection is administered by the Awards Board through its Technical Field Awards Council.

The Award consists of a bronze medal, certificate and five thousand dollars, and is sponsored by IBM Corporation. It is named in honor of Reynold B. Johnson, who is renowned as a pioneer of magnetic disk technology and was founding manager of the IBM San Jose Research and Engineering Laboratory, San Jose, California in 1952, where IBM research and development in the field was centered.

The Award was presented for the first time in 1993 to: JOHN M. HARKER.

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Maureen Quinn, Manager
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New York, NY 10017
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IEEE MAGNETICS SOCIETY NEWSLETTER CONFERENCE CALENDAR

MAY 2-4, 1994	**IEEE International Symposium on Electronics and the Environment** San Francisco, CA. IEEE/ISEEE Registrar, P.O. Box 1331, Piscataway, NJ 08855-1331; TEL: 908 562-3878, FAX: 908 562-1571.
MAY 24-26, 1994	**2nd Workshop on Finite Element Methods in Electromagnetic Wave Problems** Certosa di Pontignano, Siena, Italy Giuseppe Pelosi, Department of Electrical Engineering, University of Florence, Via C. Lombroso 6/17, I_Florence, Italy, TEL: +39-55-4796759, FAX: +39-55-4796767, E-Mail: SIENA94@INGFI1.CINECA.IT.
JUNE 20-23, 1994	**6th Joint MMM-INTERMAG Conference** Albuquerque, New Mexico William C. Cain, Read-Rite Corporation, 345 Los Coches Street, Milpitas, CA 95035, TEL: 408-956-3301, FAX: 408-956-3210, EMAIL: b2net/b2post/ccw%read-rite@mcimail.com
July 5-7, 1994	**Sixth Biennial IEEE Conference on Electromagnetic Field Computations** Grenoble, France Edward Della Torre, George Washington University, Dept. of Electrical Engineering & Computer Science, Washington, DC 20052, TEL: 202-944-5517, FAX: 202-944-5296, E-Mail: dellator@gwusun.gwu.edu
AUGUST 15-17, 1994	**TMRC '94 on Signal Processing** UC San Diego, Center for Magnetic Recording Research Roger Hoyt, TEL: 408 927-2118, FAX: 408 927-3204, E-Mail: RFHOYT@ALMADEN.IBM.COM
AUGUST 24-26, 1994	**4th International Symposium on Magnetic Bearings** ETH Zurich, Switzerland International Center for Magnetic Bearings, ETH Center/LEO, 8092 Zurich, Switzerland, TEL: +41-1-256 3584, FAX: +41-1-252 0276, E-Mail: AMB@ifr.ethz.ch
September 11-15, 1994	**13th International Workshop on Rare-Earth Magnets and their Applications and 8th International Symposium on Magnetic Anisotropy and Coercivity in Rare Earth-Transition Metal Alloys** I. R. Harris, School of Metallurgy and Materials, The University of Birmingham, Edgbaston, Birmingham B15 2TT, UK, TEL: (44) 21 414 5165, FAX: (44) 21 471 2207