IEEE MAGNETICS SOCIETY NEWSLETTER

VOLUME 25, NO. 2 SEPTEMBER 1988

CRAIG PERLOV, EDITOR

ISSUES

Bill Doyle, President

Bill Doyle

By any standard, the 4th Joint MMM-Intermag Conference held in Vancouver in July, was a success. Attendance exceeded 1100, the discussions were exciting and Vancouver is clearly one of the most civilized cities in North America. Ken Lee, the General Chairman, and his entire committee, should be congratulated on doing an excellent job.

The Administrative Committee of the Society met in Vancouver and addressed a number of routine issues. One, however, which warrants mention here is the posture of the Society towards the rapidly expanding field of applied superconductivity. It's clear, that in the next year or two, technical activities relating to superconductivity will increase in the IEEE. The exact format is being discussed now within the Technical Activities Board. The Magnetics Society, because of its history and charter, is playing a principal role. Our field of interest includes many superconducting devices such as memories, transformers, levitation systems, bearing and field sensors. All of these have been

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FOURTH JOINT MMM-INTERMAG CONFERENCE REVIEW

Ken Lee

Ken Lee

The Fourth Joint MMM-Intermag Conference was held in Vancouver, British Columbia, Canada, on July 12-15, 1988. This Conference is held in those years when the International Congress on Magnetism (ICM) is held outside the North American continent. The Joint Conference combines the Conference on Magnetism and Magnetic Materials (MMM) and the International Magnetics Conference (INTERMAG).

This Conference was a resounding success in all respects. The number of submitted abstracts was 914 and the total number of contributed and invited papers presented was 715, both of which are the largest ever for a Joint Conference, MMM Conference or INTERMAG Conference. Indeed, the total number of registrants (1182) and accompanying spouses (about 200) is the largest for any of these conferences held in North America. The international participation is reflected in the countries of origin for the first authors, which were evenly split between North America and the rest of the world.

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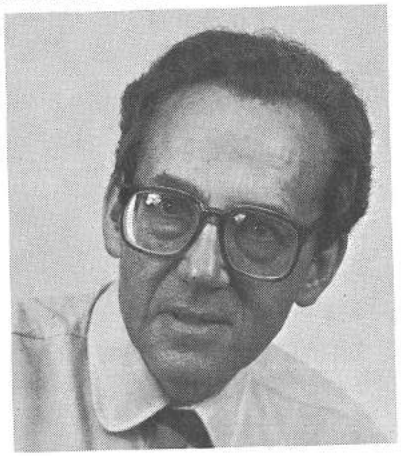
DISTINGUISHED LECTURER



Alex I. Braginski

The Magnetics Society is pleased to announce Alex I. Braginski as the Distinguished Lecturer for 1988. The Distinguished Lecturer Program is intended to provide tutorial overviews of topical subjects in magnetics, to expose students to the excitement and challenges of magnetics, and to introduce developments in magnetics to the non-technical community. Local magnetics chapters, universities, and other technical, educational, and business groups have an opportunity to hear outstanding members of the magnetics community. The cost will be borne by the Magnetics Society. Any interested group should contact the lecturer directly or the program chairman, Jack H. Judy, Department of Electrical Engineering, University of Minnesota, 123 Church St., SE, Minneapolis, MN 55455, (612) 625-7381.

APPLIED SUPERCONDUCTIVITY: A DREAM OR A REALITY?

A. I. Braginski
Westinghouse R&D Center
1310 Beulah Road
Pittsburgh, PA 15235-5098
(412) 256-1351

The recent discoveries of superconductivity at relatively high cryogenic temperatures, attaining 125 kelvin in early 1988, resulted in predictions of an enormous and almost immediate impact on the electric power and electronic technologies. In this lecture I will review the properties of high and low temperature superconductors (HTS and LTS) which are the most critical for successful applications and will discuss major limitations imposed by the peculiar nature of superconductivity in known HTS oxide compounds (cuprates). This will lead me to an assessment of technological feasibilities. The near-term prospects for utilization of HTS are brighter in electronics, especially in analog devices, than in large-scale electric power equipment. I will also show that the technical potential of LTS is considerable and, in the area of electronics, only partly exploited.

Alex I. Braginski is a Consulting Scientist and Acting Manager of the Superconductor Materials and Electronics Group at the Westinghouse R&D Center in Pittsburgh, Pennsylvania. He received a M.S. from Wroclaw Tech. Univ., Poland (1951), a Ph.D. from Polish Acad. Sci., Warsaw (1960), and a D.Sc. from Warsaw Tech. Univ. (1965). Prior to joining Westinghouse, he was Head of the Polfer Research Laboratory, Warsaw, Poland (1956-66). At Westinghouse, he worked in microwave ferrites, garnets and bubble memory technology (1967-74). Since 1975, he has been active in superconductivity. He has authored over 120 papers and was awarded 14 patents. He is a Senior Member of the IEEE and a member of the APS. In 1983-86, he was a member of IEEE Magnetics Society ADCOM and is currently Chairman of its Cryoelectric Engineering Committee. He serves on the Boards of the Applied Superconductivty Conference (ASC) and the International Cryogenic Materials Conference (ICMC).

The IEEE Magnetics Society Newsletter is published quarterly by the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, NY 10017. The objective of the Newsletter is to publicize activities, conferences, workshops, and other information of interest to the membership of the Society and technical people in the general area of applied magnetics. Copy is solicited from the S-Mag membership, organizers of conferences, officers of the Society and local chapters, and other individuals or organizations with potentially relevant material. Copy should be sent to Dr. C. M. Perlov, Hewlett-Packard Labs, MS-2U, P.O. Box 10490, Palo Alto, CA 94303.

REPORT FROM CAPITOL HILL

Clark Johnson

Clark Johnson and Congressman George Brown

Each year, the various scientific and technical societies select approximately twenty members to be Science and Engineering Fellows and to spend one year working on Capitol Hill. The program, begun in 1973, is managed by the AAAS.

I am one of three IEEE Fellows in this year's program. The Fellows are supported by their organization and are available at no cost to the Congress, where we have a history of high performance and productivity. Thus, we are in great demand. I personally interviewed with 17 Congressional offices and Committees, both on the Senate and House side.

I chose the office of Congressman George Brown (D-CA) as he has the most scientifically oriented office on the Hill, with six technically degreed staff and no lawyers or economists. The technical staff includes a leading expert on earthquakes and one on global ecology. He himself has a degree in physics from U.C.L.A, and has been in the Congress for 20 years, thereby establishing considerable seniority. He is the ranking member of the House Science, Space and Technology Committee. George takes a long view of the world and is keenly interested in what are best called the systems interfaces, e.g., the interaction between technology and economics.

Working in Washington, especially on the Hill, is quite a culture shock compared to the private sector, especially for a high-tech entrepreneur. There are few technically-trained people here and so far I have not met a single ex-entrepreneur! Logic and rationality, which rank high in our world, are virtually inconsequential in this culture of power and turf.

Having said that, there is a great need for competent technical advice and I find myself working on legislation, hearings, speeches and papers, many with considerable technical content. I recently organized a hearing on high-definition television (HDTV) and what the government's role might be in making HDTV as U.S.-based industry.

A lot of the frustration that those from the private sector experience in Washington arises from the inefficiency built into the U.S. system of government by the Founding Fathers. This is the price we pay to prevent one branch of government from overwhelming either of the others. As a result, the three branches are in near-equilibrium and enormous force is required to get anything of significance done. For this reason, major legislative agendas required massive constituent support; support that is sadly lacking on technical issues.

For example, we are the only developed country that does not have high-level science and technology input directly to the President or Prime Minister. We have a "science advisor" who, according to Simon Ramo in his book "The Business of Science," has never met with the President.

Congressman Brown supports the establishment of a Department of Science and Technology, and he and others have filed numerous bills over the years (all of which have died in Committee) to do so. The absence of an overriding executive branch organization to set priorities for the allocation of the $60 billion that the federal government spends on research and development, has left priority setting to the Congress. The Congress is uniquely incapable of setting priorities; that is clearly an Administration function. This abdication of administrative function has resulted in the wasteful duplication of effort and lack of coordination, underfunding, and undue responsiveness to lobbying.

It is very tough to make a decision as to the relative funding for, say, AIDS research and the superconducting supercollider. Lack of such priority setting is visible in the massive increases in military R&D funding with corresponding reductions in support for technology development. Yet it is technology that leads to new industries or the continuing improvement of existing ones.

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ISSUES (Continued from Page 1)

addressed at Intermag for many years. In addition, we have published the Proceedings of the Applied Superconductivity Conference (ASC) since 1977. The most likely course of events is that ASC will become an IEEE-sponsored conference, supported by several societies, including Magnetics. We have agreed not to try to expand our role in this field by seeking a merger with ASC or modifying our field of interest. Eventually, a new society, devoted to applied superconductivity, could emerge.

"Can Technical Communications Survive the Overhead Projector?" Last year, when I listed this as an issue for the Society, it was partly in jest, but also to highlight a concern about quality, standards and professionalism at our conferences and in our publications. Our lifestyle has surely become more casual. Compare the satorial splendor exhibited by airline passengers these days compared to twenty years ago. It's hard to distinguish them from the gang on a party boat in Boston harbor heading out for a day of mackerel fishing; easier, certainly, but not really better.

The late William Fuller Brown, the father of micromagnetics, was recognized as a man of extremely high standards (how many times did he point out that the Bloch wall should really be called the Lifshitz wall). The story is told that shortly after he had submitted to the Physical Review his own manuscript (W. F. Brown, Jr. Phys. Rev. 105, 1479, 1957) revealing for the first time his revolutionary concepts on micromagnetics, another manuscript (E. H. Frei, S. Shtrikman, D. Treves, Phys. Rev. 106, 446, 1957) from the Weizmann Institute group, describing very similar ideas, was sent to him for review by the editors of the Physical Reveiw. When Brown grasped the similarity of the two results, done entirely independently, he immediately wrote to the editor requesting that this new work be published as soon and as close to his paper as possible, because he felt that there should be no distinction made in priority by the technical community.

I would hope that this story could as easily be told about ourselves, today, if the occasion arose. But I have this cynicism which comes, I suppose, from getting older and having seen too much sin.

It is my impression that the review process has become less serious. Casual comments, noted in passing, and check marks in the appropriate boxes, are the rule. This is particularly true for conference proceedings with tight deadlines.

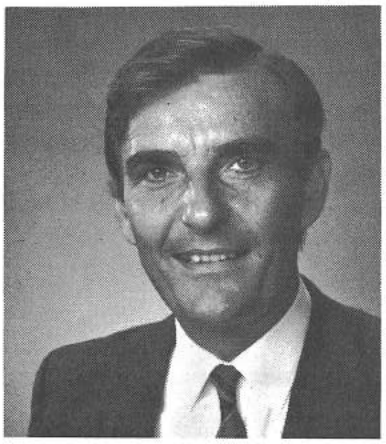
How often these days are papers seen with totally inadequate references to old work, as if each contribution stood on its own rather than on the shoulders of others? I've been told, by way of apology, that the cause of this oversight is that many data bases only go back to 1965. Seriously? What did those old guys do before they had data bases?

But how about overhead projectors? For many years, conference speakers primarily used slides, except for the occasional theorist who would doodle away with a crayon on an overhead projector dragged in from back stage. Because slides generally were prepared by professional draftsmen, the slides were usually very legible and neat. They were also uniform in format for a given talk and therefore user friendly. The advent of the PC, with graphics capability (of widely varying quality), makes everyone an artist and overheads can be made on any copy machine. The professional draftsman is a thing of the past. But we hope quality, uniformity and professionalism are not. A common fault, for example, is the author who draws his figures for the paper and simply converts them to overheads. The result–complex figures, very small letters. Another is graphs with the label of the ordinate written up the axis. Don't you love to see everyone twisting their heads sideways to read it? And then there's the familiar refrain "I know you can't see this but ...".

My own interpretation is that we're losing our ability to impose standards–casual is in. Unfortunately, while it's not a substantial loss in some areas, like airplane travel, it is in science.

What do you think?

PUBLICATIONS DEPARTMENT REPORT
Carl E. Patton



Martin Parker

Dr. Martin R. Parker of the Department of Electrical Engineering, University of South Alabama, Mobile, has been appointed the Advances in Magnetics Editor for IEEE Transactions on Magnetics.

Parker graduated with an honors degree in physics from the University of Glasgow in 1962. He was appointed Lecturer at the University of Salford in 1966 and received his Ph.D. at Salford in 1971 for work on the magneto-optics of thin magnetic films. He was appointed Senior Lecturer in 1977. He has been working since 1986 with the rank of Associate Professor at the Department of Electrical Engineering, University of South Alabama.

He has made numerous short term and long term academic visits to laboratories in Europe and the USA. In 1972 he was a German Academic Exchange Visitor to the University of Regensburg. In 1979-80 he made visits to the School of Electrical Engineering, Purdue University under a NATO exchange scientists program. In 1981 he was a British Council Exchange Scientist at the National Center for Physics in Burcharest, Romania. In 1982 he was awarded a NATO Senior Visiting Fellowship at the Francis Bitter National Magnet Laboratory, MIT, and in 1983 he was a Visiting Professor at the High Field Magnet Laboratory, University of Nijmegen, The Netherlands.

He was elected Fellow of the Institute of Physics (Great Britain) and Senior Member of the IEEE in 1985. In 1986 he was awarded a gold commemorative medal by the Royal Society of Flemish Engineers for this international committee work. He is a member of Eta Kappa Nu.

He has published over 70 technical papers on his work in magnetics, with 26 of them in the IEEE Transactions on Magnetics. He was a guest editor for the Proceedings of the International Symposium on Advances in Magnetic Filtration which were published in the May 1982 issue of the Transactions.

His responsibilities as Advances in Magnetics Editor for the Transactions are three fold: 1. the identification of state-of-the-art areas of current interest in basic and applied magnetics; 2. the identification of suitable experts in those areas and 3. invitations and logistical arrangements for those experts to prepare suitable papers for the Transactions which cover these areas. He would welcome constructive suggestions from members of the Magnetics Society on suitable topics and author candidates for such papers.

TECHNICAL ACTIVITIES BOARD PERIODICALS COMMITTEE MEETING REPORT
Chester L. Smith

The TAB Periodicals Committee held its second meeting of the year at IEEE Headquarters on Monday, June 20. Most of the problems of late issues have been cleared up. The Transactions on Broadcasting was commented on favorably for the dramatic improvements that have been made. The request of the Lasers and Electro-Optics Society for a periodical called "Optical Letters" was approved and should begin publication soon.

Chester Smith

An issue was brought to the committee by the Headquarters Staff about using the Transactions as a vehicle for Conference and Symposia Records. This practice is to be discouraged for several reasons. It has an adverse effect on the price of the All Transactions Package, but that is an issue for

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TAB (Continued from Page 5)

the Finance Committee. Conference and Symposia Records are to be handled via the Open Order Plan by the Service Center. The major concern of the committee, however, had to do with the disparity between the peer review policy for Transactions and the normally much less stringent review given Conference papers. One comment was that a meritorious paper presented at a Symposium could, indeed should, be submitted to a Transactions for review and subsequent publication, but, in general, conference papers worthwhile though they be are not suitable for Transactions. The final settlement of this question will be by the General Board of IEEE, but the Periodicals Committee is on record as being not in favor of using the Transactions for Conference/Symposium records.

In the previous notes we called attention to the Periodicals Committee's interest in a booklet for Transactions Editors similar to those on Finance and Conferences. There was some Staff opposition to this on the ground that the editors and staff work closely. While this is true, most of the lateness cases involve special issues where a one-time guest editor is in charge. The discussion also brought out the fact that Associate Editors seldom see the material furnished to the principal editor from Headquarters. The Periodicals Committee intends to go ahead with the preparation of an Editors Booklet. Staff was instructed to supply the subcommittee via Barbara Ettinger with the papers and other documentation now being used. We have an outline, but it is in for a drastic revision. Thoughts, comments, or observations would be most welcome!

Two Technical areas were brought up for discussion: "Neural Networks" and "Superconductivity". The problem here is not that these are out of the purview of IEEE, but rather that these subjects cut across the interests of several Societies. The hope Staff had in bringing these up was the Periodicals Committee might suggest ways to bring them into focus. Ladies and Gentlemen–Help!

A couple of minor points were raised near the end of the day: 1. there is no necessary reason why an oral presentation of a paper should be a prerequisite for consideration for publication in any Transactions. A nice idea but not necessary; 2. page charges are **strictly** voluntary and no paper is to be refused for failure to provide page charges.

MAGNETICS SOCIETY SCHOLARSHIP PROGRAM

We are pleased to announce the 1990 competition of the Magnetics Society Scholarship Program. This program has been established for the children of Magnetics Society members through the annual nationwide scholarship competition conducted by the National Merit Scholarship Corporation. The National Merit Scholarship Corporation (NMSC) is an independent, nonprofit organization whose major purposes are: 1. to identify and honor exceptionally talented high school students and to aid as many as possible in obtaining a college education, and 2. to enable business enterprises and other organizations to contribute more readily and effectively to the support of higher education through scholarship grants.

One Magnetics Society Scholarship will be awarded in the Spring of 1990 to a student who will complete high school requirements and who will enter a regionally accredited U.S. college in 1990 to pursue courses of study leading to one of the traditional baccalaureate degrees.

The Magnetics Society winner will be chosen through the facilities of NMSC from among children of Magnetics Society members who meet the competition requirements established by NMSC. The winner will be chosen on the basis of test scores, academic record, leadership, and significant extracurricular accomplishments.

The Magnetics Society Scholarship will be a renewable award covering up to four years of full-time study or until baccalaureate degree requirements are completed, whichever occurs first. The amount of the stipend accompanying the scholarship will be related to the individual winner's financial situation and the costs of attending the college of the winner's choice. The maximum amount that may be awarded to a winner is $4,000.00 per year; the minimum will be $1,000.00 per year.

Descriptive material and entry blanks for the Magnetics Society Scholarship may be obtained by writing to the Magnetics Society Scholarship Program Director listed below. Interested children of members should arrange to take the PSAT exam in October of this year if they are high school juniors.

Completed entry blanks must be returned to the Program Director by January 1, 1989.

Dr. Bernard R. Cooper
Magnetics Society Scholarship Program Director
c/o Department of Physics
West Virginia University
Morgantown, WV 26506

CAPITOL HILL (Continued from page 3)

The magnetic recording industry is a case in point. Its growth has been continuous over a period of nearly four decades. It is large, presently estimated to exceed $30 billion, and it is still a U.S.-based technology. It is a quintessential example of an industry meriting government support, either through the Engineering Research Centers funded by the National Science foundation, or perhaps under some of the new initiatives made possible by the recently passed Trade Bill. Yet few people in Washington are aware of the industry, its size, or of our leading technical position. Magnetics is considered to be a "mature technology" by many, including the NSF, and therefore research dollars are thought to be better spent elsewhere.

Members of Congress are responsive to their constituents. An organized campaign can work wonders. The Environmental Protection Act was successfully initiated and promoted by a group of only about 400 concerned citizens. Technical people tend to shy away from the political process and seem to have little interest in becoming involved in the political process. Yet there is an enormous constituency of some 14 million people working at so-called high-tech companies. By becoming organized and focused on problems of concern both to us and to the country, we could have a significant effect on governmental policy. Our failure to do so makes us participants by default in our nation's decline as a scientific and technical leader.

IEEE MAGNETICS SOCIETY ANNOUNCES GRADUATE STUDENT TRAVEL AWARDS

The Awards Department of the Magnetics Society of the IEEE will sponsor several graduate students working in magnetics to attend the Intermag Conference to be held March 28-31, 1989, in Washington, D.C.

Nominations will be accepted up to January 15, 1989, from faculty advisors of the interested students. This deadline will be firm. The nominator must be a member of the Magnetics Society. The nomination should be made in a one or two page letter and must contain the following information:

1. The source and extent of current support for the student,

2. Whether or not the student will be presenting a paper,

3. Whether or not the student has received a previous travel award,

4. Itemized budget requirements. If air travel is planned, the budget should be based on the most economical air fares available. It is expected that some portion of the cost will be borne by the student or his/her institution.

The awards will be announced February 1, 1989.

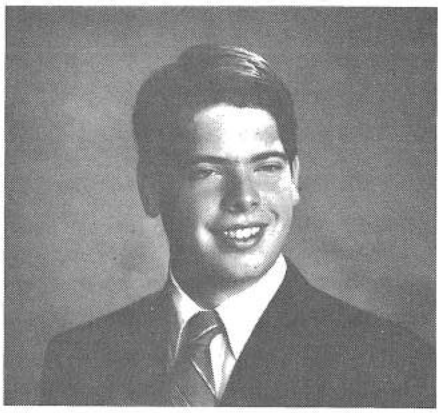
Nominations for students working in Canada and the United States should be sent to:

Prof. D. D. Stancil
Dept. Electrical/Computer Engineering
Carnegie Mellon University
Pittsburgh, PA 15213-3890
USA
stancil@gauss.ece.cmu.edu

Nominations for students in all other countries should be sent to:

Prof. P. P. Biringer, Chair
Department of Electrical Engineering
University of Toronto
Toronto, Canada M5S 1A4

MERIT SCHOLARSHIP WINNER



Alan Acker

I am pleased to announce that the winner of the 1988 National Merit Scholarship, sponsored by the IEEE Magnetics Society, is Mr. Alan Acker, son of Dr. Frank E. Acker, of Terre Haute, Indiana.

Alan will attend Purdue University for his undergraduate work and plans to become a research engineer after earning his doctorate.

Alan has taken many mathematic courses and has won several math contests. He has also taken

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WILLIAM E. NEWELL POWER ELECTRONICS AWARD

The William E. Newell Power Electronics Award is presented annually by the Power Electronics Council for outstanding achievement in power electronics. The recipient must be judged to be outstanding in the multidisciplinary field of power electronics, which crosses the technical boundaries of a number of Societies of the IEEE.

Achievements by which an individual is judged to have made outstanding contributions encompass a broad range of activities and include teaching, innovative research, consulting endeavors, professional seminars, major project or program management, and the general communication and advocacy of power electronics technology to the technical community as a whole. The technical disciplines which encompass the field of power electronics include the analysis, design, development, simulation and application of electronics devices, magnetics, controls and power circuits for inverters, converters and motor drives ranging in power levels from fractions of a watt to multihundred kilowatts.

For further information contact:

Harry Owen Jr.
PEL Awards Chairman
Electrical Engineering Dept.
Duke University
Durham, NC 27706

MERIT WINNER (Continued from page 7)

science and physics courses which resulted in his being appointed head of an Explorer electronics project to design a race track timer at Rose Hulman Institute of Technology. It also led to his employment as a lab assistant on a current faculty research project in digital control electronics. He has become proficient in several types of computer programs and has participated in a computer fair. Alan has studied field ecology and last summer went to the Mingan Island Cetacean study facility. He is now writing a research paper on humpback whale grouping and diving times.

Alan has participated in high school orchestras and has been a member of the Terre Haute Youth Orchestra for the past two years as first cellist. He has also participated in the Indiana State University orchestra and will be in the Indiana All-State Orchestra this year. Other interests are backpacking, rock climbing and novice radio operator.

MAGNETICS SOCIETY ACHIEVEMENT AWARD

1981 Fred E. Luborsky
1982 Herbert F. Storm
1983 Harold W. Lord
1985 Joseph J. Suozzi
1986 Fritz J. Friedlaender
1987 Andrew H. Bobeck
1988 Floyd B. Humphrey

FLOYD B. HUMPHREY

Floyd B. Humphrey

Floyd B. Humphrey was born in Greeley, Colorado on May 20, 1925. He received his B.S. and Ph.D. degrees in physical chemistry from the California Institute of Technology, Pasadena, in 1950 and 1956, respectively. In 1955 he joined the Solid-State Device Development Department of the Bell Telephone Laboratories, Inc., Murray Hill, New Jersey, where he studied the relations between the structure and magnetic characteristics of ferrite, flux reversal in thin ferromagnetic films and supervised the development of a permanent magnet twistor memory. In 1960 he joined the Jet Propulsion Laboratory and the California Institute of Technology, where he was concerned with the use of magnetic materials in outer space. The part-time association with the campus became full-time in 1964 when he became a Professor of Electrical Engineering and Applied Physics at the California Institute of Technology. He continued his work on the dynamic characteristics of magnetic materials. He pioneered laser flash photography to actually see the dynamic domain configurations, studying first flux reversal in permalloy then magnetic bubble wall dynamics. In 1980, he moved to Carnegie Mellon University to become chairman

of the Electrical and Computer Engineering Department, but soon returned to teaching and research. In September, 1985 he moved completely to the research track as a Senior Research Scientist. At CMU he continued the investigation of domain wall dynamics in magnetic bubble materials and bubble devices, especially magnetic bubble logic devices. Recently, he has joined Boston University Electrical, Computer and Systems Department as a Senior Research Scientist. He has been studying the feasibility of very dense vertical Bloch line memories.

Dr. Humphrey is a Fellow of the IEEE and a member of Sigma Xi, the American Physical Society and the American Vacuum Society. He has been a member of Magnetics Society Administrative Committee and the Steering Committee for the Conference on Magnetism and Magnetic Materials. In 1972 he was the General Chairman of the first INTERMAG Conference held in Japan (Kyoto). He was an IEEE "outstanding lecturer" 1973-1977 and a Magnetic Society Distinguished Lecturer in 1986. He has served in various positions on magnetics-related international conference organizations and is or has been on the editorial board for a number of journals, including the IEEE Transactions on Magnetics. He was awarded the Centennial Metal by IEEE. He has played a major role in supporting international collaboration between magneticians in many countries on three continents.

The time has come to make awards for 1989. Nominations are due for the Magnetics Society Achievement Award and the Information Storage Award by January 5, 1989. Those nominations should be carefully documented–the format of the IEEE Fellow nominations is suggested.

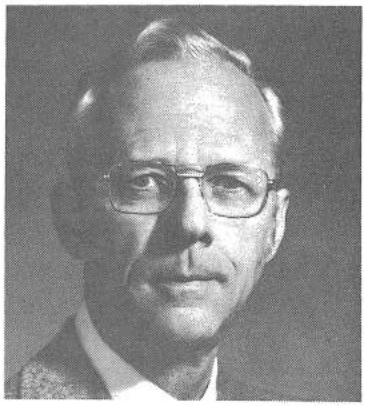
Nominations for the Achievement Award should be mailed to:

R. Fred E. Luborsky
General Electric R&D Center
Building K-1, Room 3B26
P.O. Box 8
Schenectady, NY 12301

and those for the Information Storage Award to:

Professor F. J. Friedlaender
School of Electrical Engineering
Purdue University
West Lafayette, IN 47907

INFORMATION STORAGE AWARD



Jay W. Forrester

First given at the Tokyo INTERMAG in 1987 to honor Outstanding Achievement in Information Storage for all aspects of this area such as magnetics, semiconductors or other accomplishments in this area. It consists of a certificate and a monetary award sponsored by IBM with the IEEE Magnetics Society making selection and presentation.

1987 Sidney M. Rubens
1988 Jay W. Forrester

JAY W. FORRESTER

Jay W. Forrester, Germeshausen Professor at the Massachusetts Institute of Technology, directs the System Dynamics Program in the Alfred P. Sloan School of Management. The field of system dynamics has been developing since 1956 under Professor Forrester's leadership to evaluate how alternative policies affect growth, stability, fluctuation, and changing behavior in corporations, cities, and countries.

A native of a cattle ranch near Arnold, Nebraska, Professor Forrester received the B.S. degree in electrical engineering from the University of Nebraska, in 1939 and in 1945 the S.M. degree in electrical engineering fom MIT. He has been awarded honorary doctorate degrees in engineering from the University of Nebraska, Newark College of Engineering, and the University of Notre Dame; in science from Boston University and Union College; and in political science from the University of Mannheim.

Professor Forrester was director of the MIT Digital Computer Laboratory from 1946 to 1951 and was responsible for the design and construction of Whirlwind I, one of the first high-speed computers.

Forrester (continued)

While working on computer technology, Professor Forrester invented–and holds the basic patent for--random-access, coincident-current magnetic storage which was for many years the standard memory device for digital computers.

He was head of the Digital Computer Division of MIT's Lincoln Laboratory from 1952 to 1956 where he guided the planning and technical design of the Air Force SAGE (Semi-Automatic Ground Environment) system for continental air defense, the most extensive early application of digital computer technology.

In 1956, Professor Forrester became professor of management at MIT's Alfred P. Sloan School of Management. There he applied his background in computer sciences and engineering to the development of computer modeling and analysis of social systems leading to a field now known as "system dynamics". In recent papers, Professor Forrester has described work with his associates in developing a comprehensive simulation model for examining the forces underlying inflation, unemployment, energy shortage, foreign exchange rates, mobility of people, and tax policy. By incorporating microeconomic structures at the level of industrial firms and macroeconomic structures at the national level, implications can be explored for the full range of policies that create behavior and cause difficulties in the socio-economic system. Professor Forrester has written a number of major books in the system dynamics field.

Professor Forrester's work and his books have brought him numerous national and international awards and honors. He received the Inventor of the Year Award from George Washington University (1968); the Valdemar Poulsen Gold Medal from the Danish Academy of Technical Sciences (1969); the IEEE Medal of Honor (1972), "For exceptional advances in the digital computer through his invention and application of the magnetic-core random-access memory, employing coincident current addressing"; and the IEEE Systems, Man, and Cybernetics Society Award for Outstanding Accomplishment (1972), the New England Award (1972) of the Engineering Societies of New England; the Howard N. Potts Award (1974) from the Franklin Institute; Honorary Membership in the Society of Manufacturing Engineers (1976); the Harry Goode Memorial Award of the American Federation of Information Processing Societies (1977); was inducted into the National Inventors Hall of Fame (1979); received the Common Wealth Award of Distinguished Service (1979); and the Computer Pioneer Award from the IEEE Computer Society (1982); Jay W. Forrester Chair of Computer Studies, endowed by Thomas J. Watson, Jr. (1986); James R. Killian, Jr. Faculty Achievement Award, Massachusetts Institute of Technology, 1987.

Professor Forrester is a member of the National Academy of Engineering, and a Fellow of the Institute of Electrical and Electronics Engineers, the Academy of Management, the American Academy of Arts and Sciences, the American Association for the Advancement of Science, and a Benjamin Franklin Fellow of the Royal Society of Arts (London).

I am honored on behalf of the Magnetics Society to present him with the IEEE Award for Information Storage.

A NOTE FROM THE EDITOR

I'd like to take this opportunity to bring a few items of interest to your attention. First, some of you may recall the article in the last Newsletter by Bob White expressing his concern over both the lack of support by United States corporations for research in basic magnetism for future technology and the lack of government support for research in magnetics. Well, I sent copies of this article to about 20 companies (as well as subsequent follow-up letters) but so far the only written response I have received is a letter of disinterest from DuPont. I also sent a copy of the article to the White House and their response was amazing and unexpected; I received a form from Mr. Whitehead at the Department of Education to apply for funds for "Drug Prevention Programs in Higher Education". The view from Washington certainly appears to be unique. There is a nice article by Clark Johnson in this issue about his experience working in Washington.

In this issue you will also find session summaries from the recent Joint MMM-Intermag conference in Vancouver. I wanted to get these to you in a timely fashion and unfortunately one ramification of this is that I have only received about half the session summaries. Any others I receive, I will

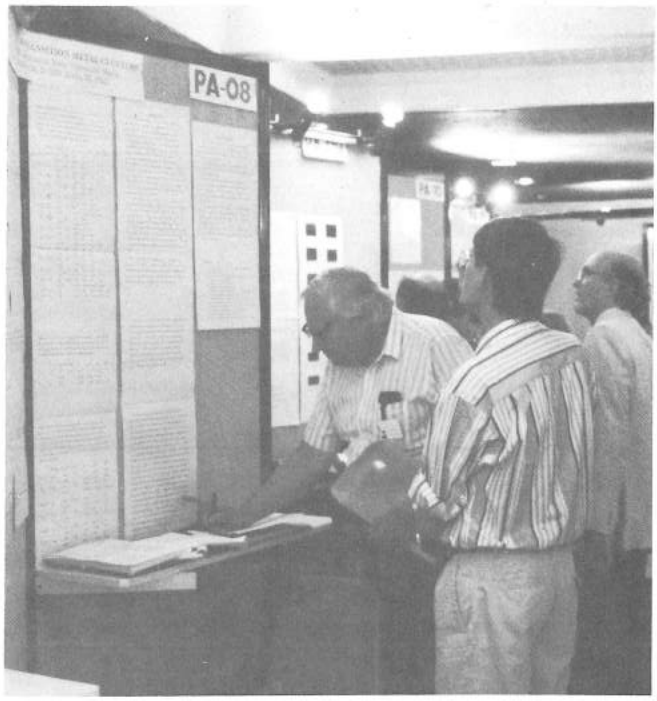
Continued on Page 32

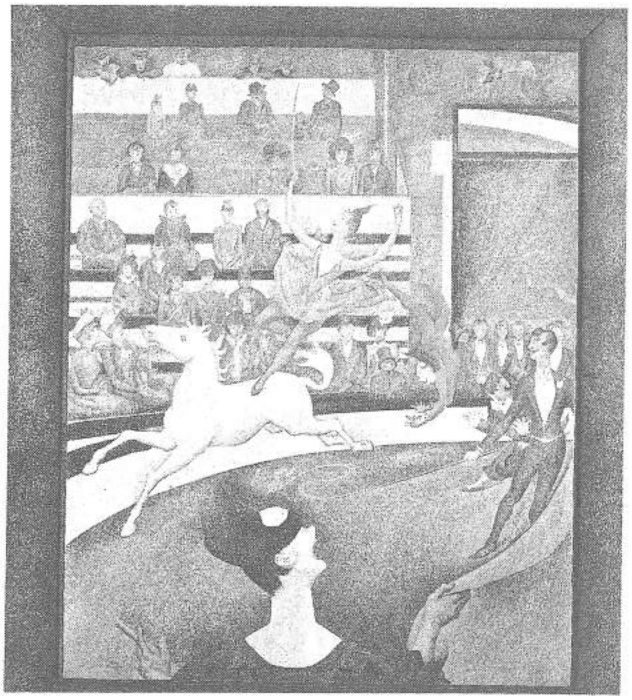
ICM

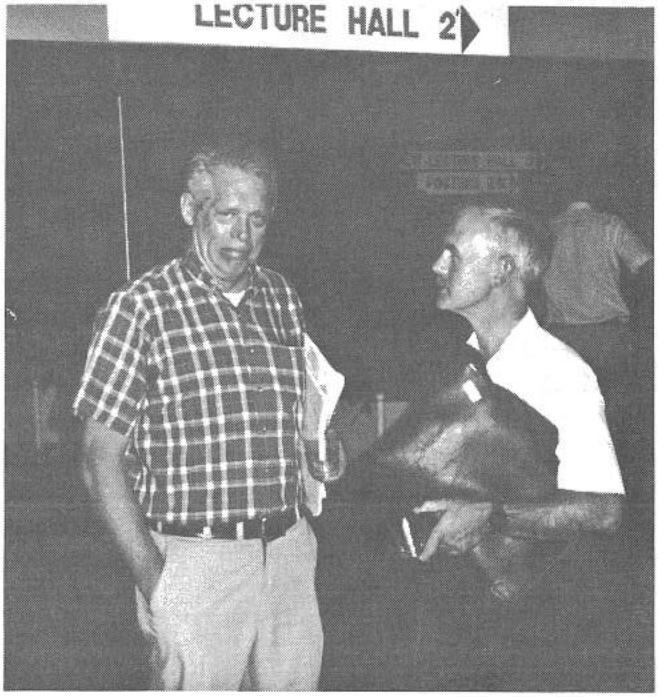
The International Conference on Magnetism was held in Paris on July 25-29, 1988. Sponsored by the International Union of Pure and Applied Physics it was held at the Faculte de Droit near the Jardin du Luxembourg. The Proceedings of ICM88 will be published by Les Editions de Physique in the series "Colloques."

A unique feature of this conference was that there was a time reserved for the poster sessions in which no oral presentations were given. In this manner they were able to accomodate a very large number of posters.

The conference reception was held at the Cirque d'Hiver made famous by Seurat's pointilist painting. After a command performance a lavish spread was made available to conference participants backstage.

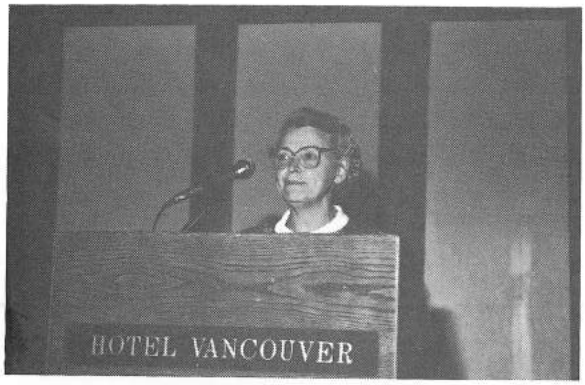


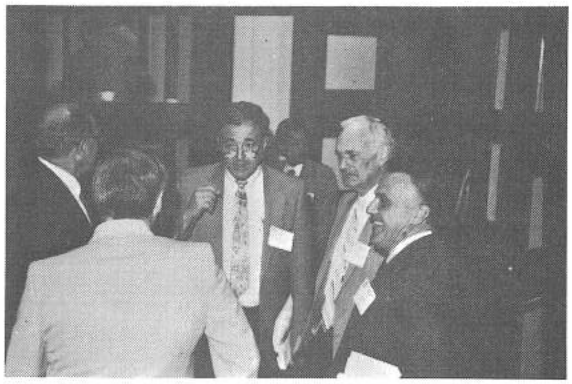


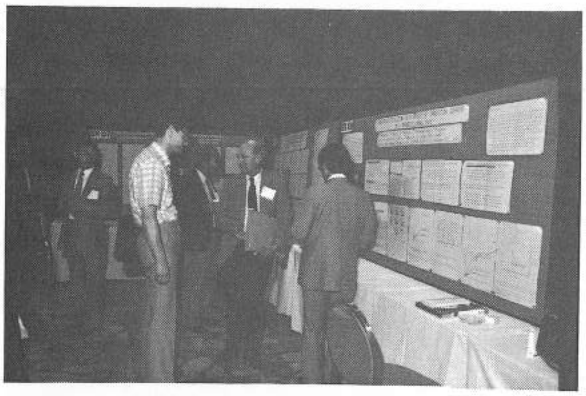


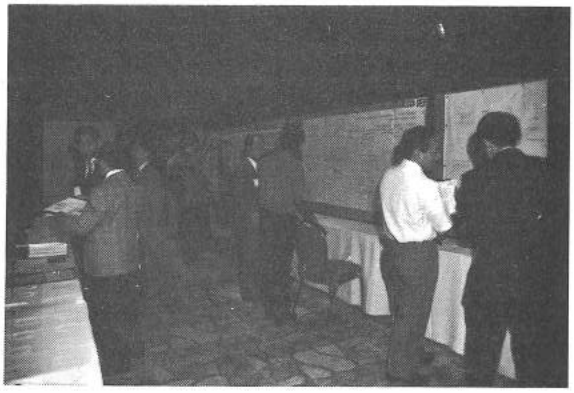
INTERMAG (Continued from page 1)

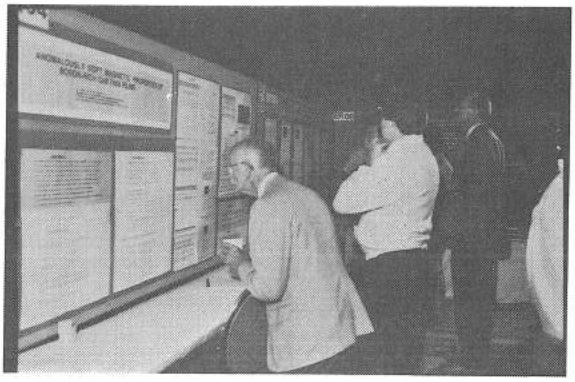
A very informative and thought provoking plenary talk was given by Professor Mildred Dresselhaus of MIT. Her talk, entitled, "Advancing Our Research Capability Through University, Industry and Government Collaboration" stimulated considerable discussion on the state of health, or lack thereof, of science and engineering research support in the United States in general and in magnetics in particular. She pointed out the necessity for the magnetism and magnetics community to make more coherent and consistent promotional efforts with government leaders and agencies to solidify the fine efforts recently initiated by industry. It was also pointed out that the number of U.S. citizens entering science and engineering fields is continuing to decline. Professor Dresselhaus stated that this latter problem could be somewhat resolved by placing more emphasis on training more, and better, science and mathematics teachers as well as providing them with more support. As expected, her talk generated numerous questions and opinions from the audience.

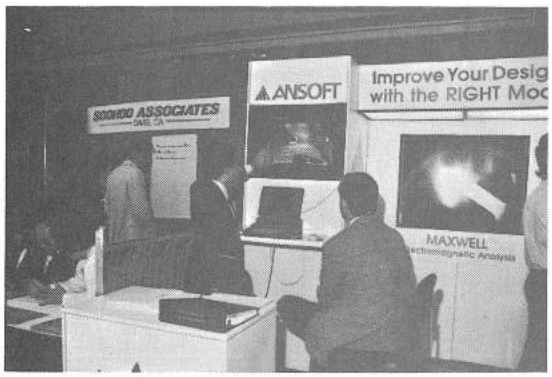


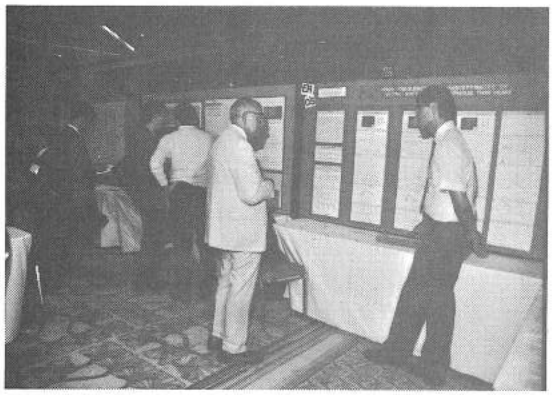












SESSION REVIEWS

Session: #AE
C. D. Mee

This session concentrated on the magnetic processes occurring during thermomagnetic writing of small diameter domains. However, the first invited paper described the development of a high-resolution magneto-optic head using a 20mm A1GaIrP diode laser with 667mm wavelength. Due to the small written spots, a recording density increase was achieved enabling 1-GB recording capacity on a 5-inch-diameter disk.

The second invited paper considered magnetic media design and the thermomagnetic recording conditions to produce written marks with controllable shape and maximum magnetization. The relationships of the resulting mark shapes to the micromagnetic magnetization reversal processes were explained by a model of domain formation. The dependence on the magnetic properties of the recording media were shown experimentally. Several subsequent contributed papers added more insight into the correlation between recording noise and the magnetic properties of the media.

Two papers considered in more detail the thermomagnetic writing process. These studies related the lateral and vertical temperature profiles induced by the beam, and the formation and annihilation of domain walls during writing and erasure. The effects of adjusting the Curie and compensation temperatures on the control of the domains were measured. In addition, in subsequent presentations the modification of the thermal profiles in multilayer media structures was also modeled. Finally, the effects of the magnetic bias field ampliture on themomagnetic writing were

explained by a calculation of the resulting forces on a circular domain wall. Significant changes in written bit diameters were predicted.

Several measurement techniques were described for observation of the domain structures in magneto-optical materials.

Extensive use of Lorentz microscopy and optical Kerr effects for static measurements was supplemented with dynamic measurements using a high-speed scanning laser technique. Less direct measurement of recorded spots was also described using an analysis of readout waveforms. Dynamic reversals were also simulated from the application of the Landau=Lifshitz-Gilbert equation to an array of magnetic dipoles.

Finally, a new technique for acheiving direct overwriting of a thermomagnetically recorded pattern was described. This technique relies on the efficient generation of an oscillating recording field coupled with timing of the laser pulse controlled by the recorded information.

Session: AF
Jack H. Judy

An invited talk given by Professor Yoshihisa Nakamura of Tohoku University compared theoretically the recording characteristics and limitations of perpendicular and longitudinal magnetic recording. He used the curling mode for magnetization reversal and showed that the longitudinal mode is limited by the recording resolution of the medium or to bit lengths equal to about twice the medium thickness. However, the perpendicular mode is limited only by particle diameter and reproducing head sensitivity such that recording densities as high as 1 bit/square micron are now feasible and 400 bits/square micron will be possible in the future. Artley et al from ICI and Tohoku University discussed origins of nodules formation in CoCr films sputtered on polyimide substrates as being due to contamination or exudates which severly limit durability. An alternative substrate of poly-ether-ether-ketone (PEEK) was introduced which shows no exudates or nodule formation. Luitjens et al from Philips presented signal and noise spectra of single layer CoCr media using metal-in-gap ring heads and showed that densities as high as 100 Mb/cm^2 are possible. Kiuchi et al from Fujitsu gave the magnetic properties of CoCr films RF sputtered on 200 A Ti underlayers on glass and NiP-plated A1 disks. Films depositited on glass disks had perpendicular coercivities higher than 2000 oe and 10-30% above those films deposited on NiP/A1 disks. Tagami et al of NEC reported on shape-induced and magnetrostriction-induced magnetic anisotropy of sputtered CoCr films deposited on 1 micron wide and 300-1400 A deep grooved tracks formed on SiO_2 layers deposited on Si substrates. Tamai et al of NEC reported on the superiority of magnetron sputtered CoCrTa films over CoCr films in resisting the effects of impurity gases on magnetic properties. Hirono et al of NTT showed that the perpendicular coercivity of RF and DC magnetron sputtered CoCr films can be significantly enhanced at high deposition rates by initially depositing a 100 A thick layer of CoCr at low power on a 300 A underlayer of Ti. Kitakami et al of Hitachi-Maxell showed that high-coercivity CoCr films as thin as 200 A can be obtained by evaporation on a 200 A Ti underlayer on polyimide. Jeanniot et al of BULL reported on the effects of RF sputtering conditions used for NiFe and Ti underlayers on improving the magnetic properties and recording performance of CoCr films deposited on glass disks. Brucker et al of Kodak discussed a novel plasma-enhanced evaporation of CoCr thin films on polymer substrates which increased the perpendicular coercivity at lower substrate temperatures.

Session: AG
E. Della Torre

The overwhelming majority of papers in the micromagnetic session involved the numerical modeling of magnetization patterns. The first two papers and a last minute addition by Schabes and Bertram discussed fine particles. It is seen that the remanent state is not uniformly magnetized and the magnetization reversal modes can be quite complicated.

Most of the others involved 2D and 3D calcualtions in thin films. The finite element method is the preferred method to use because of its flexibility in describing complicated geometries. A novel extension of this method involved the use of dynamic grids to compute domain wall patterns by Neil Smith. Yoo et al attacked the problem of interaction between two magnetic layers.

Session: AQ
Dan Bloomberg

Many heads were turned in this well-attended poster session. Work was reported on metal-in-gap (M-I-G) heads, MR heads, heads for perpendicular recording, video heads, and superconducting heads!

The considerable interest in M-I-G heads is due mainly to their ability to produce larger head fields than ferrite heads. Lee et al showed that for a M-I-G head, the addition of metal on the trailing edge surface eliminates nulls from any secondary gaps between the metal and ferrite. Kelley used numerical modeling to demonstrate the dependence on metal thickness of the deep-gap field in M-I-G heads. The maximum useful field was shown to be about 3/4 of the saturation induction of the metal. Sufficiently near the pole tips, the field exceeds the saturation induction!

Maruyama et al constructed and analyzed a set of self-biased MR heads with a Ti shunt layer placed between the MR element and the CoZrMo soft adjacent layer (SAL). (This differs from similar heads that use an insulating layer instead of Ti). Performance is optimized when the M_sT product of the SAL is 3/4 that of the MR layer. Much useful design data were presented.

Vos and Judy investigated the theoretical read response of an unusual head geometry for perpendicular recording. The frequency response surprisingly showed no evidence of the existence of a well-defined read gap in the structure. Schewe modeled the ability of a thin-film head with different pole thicknesses to compensate for transition asymmetry generated in double-layer perpendicular recording.

Johnson and Huijer studied the dependence of rubbing noise on tape velocity in video recorders. Because of magnetostriction in crystalline MnZn ferrite heads, acoustic waves generate flux changes in the head. The observed noise spectra correlated well with a model for standing acoustic waves in the heads. Umemoto et al used high coercivity tape, with a head composed of laminations of amorphous CoNbZr and SiO_2 layers to record a 150 Mb/sec channel (one of 8 in a HDTV system). With careful design of detection channel electronics and equalization filter, they achieved a CNR of 31 dB.

Dugas et al investigated some possibilities for using Y-Ba-Cu-O high T_c superconducting bulk materials to construct recording heads. They achieved a sensitivity of 3 flux quanta with Josephson junction (SQUID) sensors. The (Meissner) diamagnetism of the materials was poor.

Session: BA
Richard Gerber

The session on magnetic separation consisted of eight papers.

The opening paper, by M. F. Haque; S. Arajs (speaker) and C. Moyer, Department of Physics, Clarkson University, reported recent results of experimental studies in magnetic separation of ultrafine hematite particles. These submicron particles, suspended in aqueous solution, were passed through a ball matrix filter under conditions of constant flow rate and carefully controlled solution pH. Filtration efficiency was measured as a function of the magnetic field strength and pH of the solution up to saturation values both of which were shown to depend upon characteristic parameters of the separation system.

In the second paper, by D. R. Kelland (speaker) and M. Takayasu, Francis Bitter National Magnet Laboratory, MIT, the problem of selectivity in the separation of multiple-component particle suspensions, using HGMS in the repulsive mode of the axial configuration, was investigated. High selectivity ratios for both components of the two-component slurry (CuO and A1 in $MnCl_2$ solution) were achieved by using a two-stage axial separator, where the second stage was operated orthogonally to the first stage as far as the magnetic field direction is concerned. Encouraging results on the application to coal desulfurization of the novel two-inlet/two-outlet axial separator were also presented and discussed.

The third paper, by J. Svoboda, F. J. Friedlaender (speaker), Hua Fu and S. W. Luan, School of Electrical Engineering, Purdue University, was concerned with particle collection on a nickel wire mounted at various angles to the applied field. Interesting experimental results, e.g. collection taking place even at an angle of 10^o between wire axis and field direction, were presented. Attention was drawn to previous theories based on contradicting assumptions.

In the fourth paper, by J. Boehm (speaker) and R. Gerber Department of Pure and Applied Physics, Salford University, the effects of particle

scattering upon open gradient magnetic separation (OGMS) of a two-phase mixture of material were analysed. The properties of the falling particle stream were described theoretically and the theory compared with experiments. From that, the parameters characterizing the performance of OGMS systems were established and discussed.

The fifth paper, by J. M. Turner, M. R. Parker (speaker) and D. Fletcher, King Edward VII School, UK, EE Department; University of South Alabama and Physics Department Sultan Qaboos University, Oman, respectively, gave resutls of a computational study of vertically stacked OGMS arrays of high current density coils. Both linear and non-linear stacks are considered and their performances compared. Implications for OGMS system design were discussed and in conclusion also some analysis of diamagetic separation was also carried out.

The sixth paper, by R. Gerber (speaker) and A. Gall, Department of Pure and Applied Physics, Salford University was concerned with a detailed theoretical description of magnetic filtration by an array of magnetic slabs. Both the equivalent surface current theorem and the Schwarz-Christoffel transformation were employed in the theoretical model which, after deriving the equations of motion, yielded the particle trajectories and critical entry coordinates. From these the separation efficiency of the permanently magnetized rectangular slab filter system was established as a function of the system geometry and the magnetic-to-fluid velocity ratio.

The seventh paper, by M. R. Parker (speaker), EE Department, University of South Alabama, followed recent developments of Halbach in small permanent magnet design to adapt these for the construction of permanent HGMF filters. Ordered matrices were considered for these filters. It was suggested that they may be efficiently cleaned by a coherent rotation which would bring fiber axes parallel with the field direction. The torques required for this operation were calculated and found relatively small.

The last paper of the session, by D. R. Kelland (speaker), M. Lai-Fook, E. Maxwell and M. Takayasu, MIT National Laboratory and I. S. Jacobs and M. D. McConnell, General Electric Corporate Research and Development, was devoted to improvements in the HGMS performance in removing mineral pyrite from coal by increasing pyrite's magnetization. This was achieved through selective heating of the pyrite by high power density microwave irradiation. Thermal analysis showed that temperatures reached in the pyrite were higher than those in the coal. Vibrating sample magnetometry, Mossbauer spectroscopy and electron micro-probe photography were employed to determine the degree of conversion of pyrite to ferrimagnetic monoclinic pyrrhotite.

Conventional and continuous axial HGMS systems were used for separation and assessment of pyrrhotite-coal samples. In conclusion, besides the insight into the process of conversion, high power short-time irradiation was demonstrated to be effective in substantially improving HGMS coal desulfurization.

Session: BC
J. Strom-Olsen

The most interesting paper of the session was an invited contribution by Das Sarma on the Landau levels in a two dimensional electron gas. Das Sarma showed that if the electron screening is carried out correctly much of the structrue in the Landau levels is washed out, leading to a rather smooth DOS variation with field, as has been seen experimentally. Similar, though less dramatic effects, are expected in three dimensions. R. W. Cochrance presented data on the hall effect in NiZr, which taken with the same author's work in FeZr, stressed the unusual magnitude of the extra-ordinary contribution due to Ni side jump. L. Berger presented an analysis of the temperature dependence of the ferromagnetic anisotropy of resistivity on the basis that the ratio of the spin up and spin down band widths is quite different for phenon scattering and and impurity scattering. The session opened with two papers on U based magnetic alloys and amorphous NiTi where the importance of quantum corrections to the conductivity was stressed.

Session: BD
P. W Wigen

In the first paper of their session, evidence of ballistic transport of energy by large wave vector magnons was reported in the MnF_2 and YIG. Using tunable lasers and/or heat pulses, nonequilibrium magnons at high k values were created at

one surface of the material and detected at the other via a superconducting bolometer. The slow moving magnons were distinguished from the higher velocity phonons. These new observations of the long lived ballistic magnons give an opportunity to study the properties of high energy magnons and a possible technique for using these high frequency magnons for spectroscopic purposes was proposed.

Two papers reported studies on auto-oscillations in YIG films. The one used perpendicular resonance geometries, the field and power dependence of the route to chaos in ferromagnetic resonance was reported showing periodic, period doubling and chaotic behaviour with typical auto-oscillation frequences in the 10 MHz range. The second paper used parallel resonance geometries observing of the auto-oscillations at subsidiary resonance. Three different routes to chaos were observed. The first was a broadening of the auto-oscillation power spectrum directly into chaos, second a period doubling bifurcation process and third both odd and even period bifurcations on the route to chaos. Typical oscillations in these geometries were .1 to .5 MHz. These two papers show the versatility of magnetic systems for nonlinear studies.

In another paper the use of light-scattering to investigate both the magnitude and the direction of the parametrically excited magnons was reported in subsidiary resonance. Two inconsistencies between the observations and the theory were reported. The first was the lack of observation of a predicted flip of the parametric excited magnon from the in-plane to the out-of-plane direction and the second was the lack of the change in the magnitude of the parametrically excited magnon to zero k values over a certain range of the magnetic field. These two observations raise some serious questions about the theory of critical field phenomena, which were considered briefly in the paper.

Another paper reviewed the spinwave instability threshold and linewidth in single crystal spheres of gallium and scandium doped YIG. Detailed analysis of the critical field parameters h_c and the Δ_k the spinwave linewidth were reported.

In another paper the domain mode ferromagnetic resonance in low q ($q=0.2$) magnetic garnet films were reproted using a shorted microstripe transmission line. Both the in-phase and out-of-phase mode in a parallel stripe unsaturated specimen were observed in 0 field and compared with the theoretical results for the known parameter of the film.

Session: BF
Irene A. Beardsley

Sonobe et al investigated spacing loss for perpendicular recording in the small spacing regime for ring heads and single layer (floppy) media. The write spacing loss correlated with the asymmetry of the readback pulse, and both were related to head/medium characteristics. The write loss can be reduced to near that in longitudinal recording by using a MIG head and high H_k and H_c media.

Jeanniot studied the effect of flying height on amplitude and D_{50} for rigid disks in the low spacing regime. The vertical single layer media reached a higher density than the longitudinal single layer for close contact. Vertical double layer media showed an increase in sensitivity due to the strong coupling in contact.

Okuda and Ashar presented an analytical head field model for a single pole head with underlayer, using a combination of a superposition method far from the pole tip, and a charge distribution method near the pole tip. Results were compared with fields of a scale model. Side fringing fields fall off more rapidly than those from a ring head.

Arnoldussen developed a modular transmission line/reluctance model and an adaptation of the model to thin film heads. The model includes external fringe fields and allows changes in the geometry without the need for extensive reformulation.

In an invited paper Bertram and Beardsley presented extensive 2-D self-consistent modeling of the write process in thick particulate media. The results can be interpreted by considering two populations of particles with their easy axes up and down with respect to the recording plane. The phase difference between these populations can account for low and high current nulls and current optimization. The role of demagnetization fields and spacing were examined.

Otter, working in 1-D, used an approximation to the longitudinal magnetization as a function of depth into the media to predict the saturation current for recording in thick media. The time dependence of the coercivity was introduced to improve agreement.

Eiling applied his 2-D write process model to AC-bias recording. He investigated the dependence of the maximum output level at long wavelengths at a given harmonic distortion level on system parameters.

Weisen and Charap presented a modification of the Preisach algorithm in which the magnetization changes are weighted by a state-dependent quantity. The identification problem from first order loops is solved and minor loops close.

Noyau et al developed an improved analytical model for digital recording on thin media which includes the effects of varying deep gap fields. Agreement with experiment was quite reasonable.

Weismehl et all used a measured thin film head field to deconvolve the readback waveform and obtain transition shapes in thin film media. A polynomial fit was applied to the readback waveform to reduce noise in the deconvolution.

Session: BP
Robert Kost

There were six papers in this poster session. The topics included combined RLL-error correction codes, controlled pulse polarity codes, Viterbi decoding and write equalization.

Lin and Wolf at UCSD discussed combining RLL codes with trellis codes that would have a single error correcting capability. Among others they discussed a (1,3) code with a Hamming distance of 4 and a (2,6) code with a Hamming distance of 3.

French, Weathers and Wolf from UCSD discussed a (d,k) code that had pulse polarity control. This resulted in an increased timing window and a pulse amplitude reduction for some pulses. They also discussed and simulated the qualifying circuits for this code.

Schneider from IBM had two papers. One paper discussed the generalization of a write equalization idea that he had presented in 1985 for the (0,3) code that is used on the 3480 tape drive. The other paper discussed using the Viterbi detector used in conjunction with a partial response modulation scheme.

Session: CZ
Daniel D. Stancil

Session CZ consisted of three invited talks designed to introducenonspecialists to superconduictivity and to the properties and potential applications of the new high temperature materials.

Professor M. R. Beasley from Stanford University presented a very lucid introduction to the phenomenon of superconductivity. He pointed out that a sharp drop in resistivity is not sufficient for demonstrating supercondictivity; the hallmarks of superconductivity also include flux exclusion (Meissner-Ochsenfeld effect) and flux quantization. The two-fluid model and how it leads to an equivalent circuit model consisting of parallel resistance and inductance was also discussed. Other topics included the difference between type I and type II superconductors; the interrelations between critical current density, critical fields, and temperature; and the electron-phonon interaction.

The second talk of the session was presented by Professor M. Brian Maple, from the University of California, San Diego. Professor Maple introduced the new copper oxide high temperature materials and their properties. The new materials are type II superconductors with critical temperatures as high as 125 K and upper critical fields that are estimated to be between 100 and 200 T. The electrical and magnetic properties of single crystal materials exhibit a strong uniaxial anisotropy with maximum critical current densities greater than 10^6 A/cm^2. The critical current densities observed in polycrystalline materials are several orders of magnitude smaller, however. This may be due to the random orientation of anisoptropic grains or to weak coupling at grain boundaries. The electron-electron interaction is not understood in these materials, but mechanisms of magnetic origin have been proposed.

The final talk of the session was delivered by Dr. William J. Gallagher, from the IBM Watson Research Center. Dr. Gallagher discussed both large- and small-scale potential applications. An interesting point made was that we should not underestimate the value of "toys" such as the levitation kits which have become popular during the past year. These toys permit widespread exposure of the materials and may contribute to unforseen innovations and applications. Significant improvements in material properties are needed before large-scale applications such as magnets and transmission lines become attractive. Key problems are the brittleness of the materials and the low current densities of polycrystalline samples. Microelectronic applications based on thin films

are much more likely to be successful in the next five years.

Session: EB
F. F. Dillon, Jr.

A more complete title for this session would have been "Magnetoopitical (MO) Materials and Dilute Magnetic Semiconductors (DMS)." It began with an invited paper by de Jonge and collaborators in Eindhoven, Warsaw and Antwerp reporting on the appearance of a ferromagnetic state in the DMS $Pb_{1-z-y}Sn_yMn_xTe$ which abruptly appears when the hole concentration exceeds a critical value of about 3×10^2 cm^{-3}. The authors described a simple two band model which accounted quantitatively for the observed behavior. In a second DMS paper Krebs et al described work on films containing Co rather than the usual Mn, specifically $Zn_{1-x}Co_xSe$. Its magnetic properties resemble those of $Zn_{1-x}Mn_xSe$, but there are important low symmetry effects at low concentrations.

The following three papers dealt with metallic films pertinent to magnetooptical recording. Kunimoto reported the preparation of a wide range of PtMnSb samples and the correlations found between preparation conditions and magnetic properties. In a careful study of rare earth-FeCo thin films, Weller et al demonstrated the correlation between x-ray photoelectron and MO spectroscopies. They found evidence for f–d transitions in NdFeCo and YbFeCo, and saw intermediate valence behavior in the latter. Gambino et al explored the MO storage possibilities of bilayer films in which a readout layer with high MO rotation is exchange coupled to a storage layer with appropriate coercive properties.

The remaining papers dealt with the magnetooptics of ferrites and garnets. Ostorero et al studied the MO and magnetic properties of $Cd_{0.25}Co_{0.75}Fe_2O_4$ single crystals over a wide range of field and temperature. They encountered large Faraday rotations and magnetizations and a field induced transition which is to be associated with Co^{++} on tetrahedral sites. Ferrand et al dealt with garnet double layer structures to be used in MO read heads. Guillot et al reported work on the Faraday rotation of terbium yttrium iron garnets in $6 \leq T \leq 300$ K. Below 120 K they encountered the huge anisotropies associated with the Tb^{3+} ion. Nakajima et al reported the preparation of an improved $(YbTbBi)_3Fe_5O_{12}$ epitaxial thick film on a specially chosen substrate. Because this can be grown as a thick film, and has a large rotation it is very attractive for isolators at 1.31 and 1.55 μm. Wolfe et al described experiments to determine the behavior of the optically active layer in MO waveguide films. This involves a new kind of MO hysteresis loop in which Faraday rotation is plotted as field is rotated in the plane.

The session ended somewhat prematurely when no one appeared to present two papers from the USSR which had been accepted by the Program Committee and scheduled for the session.

Session EC
Kristl Hathaway

In an invited paper, Professor B. Cooper et al described a first principles computational technique to treat systems with strong intra-ionic correlation but with a moderate amount of hyridization, i.e. certain 4f systems. In the initial stages of the calculation the f-electron levels are treated as resonant states (prevented from hybridizing) in a local-spin-density approximation band structure calculation, iterated to self-consistency. The 4f levels are then allowed to hybridize within the self-consistent potentials, yielding parameter values for a model Hamiltonian. The solutions of the model Hamiltonian are used to interpret physical properties. Their main observation is that, as hybridization effects increase, the coupling between orbital moments on the ions begins to dominate the magnetic behavior of the system and, in some cases, can drive the system through a magnetic instability. The insights to be gained from such calculations were illustrated in the next paper by G. H. Hu and Cooper. Parameters obtained from first principles calculations on cerium and light actinides were extrapolated to give crystal field and interaction parameters for the uranium (3+) ion. These parameters yield a complex level structure which, when combined with a hybridization relaxation mechanism, may account for the observed width of magnetic scattering distributions in uranium compounds.

The third paper by J. B. Goedkoop gave a very interesting review of experimental magnetic x-ray dichroism work on rare earths. The technique measures photoelectron yield as a function of incident x-ray polarization, and gives a quantitative measure of the local magnetic moment.

The session then proceeded to two papers on electronic structure calculations of transition metals. Moruzzi and Marcus have calculated the total energy and magnetic moment of the 3d transition metals from Sc to Ni in the bcc structure, for a wide range of lattice constant, and find that all of these elements undergo fairly abrupt magnetic transitions at well-defined critical volumes. Brener et al also observed transitions from zero- or low-moment states to high-moment states in certain metastable transition metal structures.

H. J. F. Jansen has used a simple parameterized Hamiltonian model, including spin-orbit coupling, to investigate the relative contributions of various terms to the observed magnetocrystalline anisotropy. He finds that in order to reproduce experimental anisotropies with a physically reasonable value of the spin-orbit parameter, one must include an effective field coupling to the orbital angular momentum. This coupling arises from correlation effects and/or the Breit interaction. The final paper by S. S. Peng and Jansen presented a computation in which ab initio total energy calculations for the ferromagnetic ground state and several hypothetical antiferromagnetic states of iron were used to obtain exchange couplings up to third nearest neighbors. Insertion of these couplings into a Heisenberg Hamiltonian yields a Curie temperature of 895K.

Session: ED
S. R. H. Hoole

This session, originally envisaged to have a total of 13 papers, saw the presentation of 12. S. J. Salon of RPI presented an invited paper on the important topic of inverse problems. He treated the specification of global constraints, such as of force in the airgap of a nonlinear C-core, with a Newton-Raphson expression for the difference between the required force and that from the finite element computation set to zero. The corresponding airgap is determined from this. P. Molinari, M. Repetto, A. Metron and A. Di Vita from Italy presented extensive parametric studies of a hybrid wriggler using three dimensional finite element code and drew important conclusions from their results. Chang-Chou Hwang and S. J. Salon presented a preprocessor for analyzing a motor in motion with electromechanical coupling. D. A. Lowther, E. M. Freeman, C. E. Emson and C. M. Saldanha read a paper on the application of knowledge based systems to the design of electrical devices. They made a distinction between well established design procedures about which we have "archived" expertise and those that have no such procedures and went on to share their experience in constructing knowledge based systems for these two classes. S. B. Allison, Z. J. Cendes and D. N. Shenton showed how the metropolis algorithm may be used in constrained magnetics design problems. Using statistical fluctuations, their method avoids convergence to local extrema. Some practical applications were also demonstrated.

P. J. Leonard and D. Rodger presented the solution of field problems when it is the voltage, rather than the current, that is prescribed. The extra voltage equation is introduced in terms of the current and ohmic properties of the windings and the matrix equation is rendered symmetric by using an integral expression for the total current. They demonstrated the method in three dimensions using an A-Psi formulation. T. Nakata, N. Takahashi, K. Fujiwara and A. Ahagon considered the same problem as Leonard and Rodger. Their approach differs in that they consider the magnitude of the current density as an unknown extra constant and solve using a vector potential formulation. They too addressed the issue of making the matrix symmetric and proceeded to relate their approach to the conjugate gradients algorithm.

B. B. Shyamkumar and Z. J. Cendes read a paper on the convergence of iterative methods for nonlinear problems. Case studies of several methods, between the two extremes given by the Newton scheme and linear iterations, were made. The appropriateness of each method to the magnetic field variable being solved for, was also addressed. S. Yamada and K. Bessho considered the computation of harmonic fields in electric machinery, coupling the finite element method with the harmonic balance method. The use of various B-H models was also treated. S. R. H. Hoole, G. Stevens and T. Walsh treated the automatic determination of mixed order finite element matrices to make adjacent finite elements of different order conform along the shared edges. Such procedures allow p-type adaptive refinement to be carried out automatically with elements of higher order only in regions of high error.

Providing a change from the differential methods used so far, H. Tsuboi, H. Tanaka, T. Misaki and

M. Fujita used integral methods to analyze an RF antenna used for medical imaging. The last paper also was an interesting departure from the tenor of the preceding papers. R. O. McCary and J. R. M. Viertl showed how automatic eddy current systems using image processing may be used for in-service tests of ferritic steam turbine/generator rotor bore surfaces. This method is much more cost effective than the presently used magnetic particle testing method. Moreover, the new method allows repeatability and characterizes the defects.

Session: EF
Robert G. Walmsley

Twelve papers were presented in this session. Of these, three discussed flexible media and the remainder rigid media. Improved test procedures and carbon overcoats were the primary focus for rigid disc applications. Paper EF-01 deviated from unanimity and reported excellent wear, friction and corrosion performance from ZrO_2/Y_2O_3 and $ZrO_2/Y_2O_3/Al_2O_3$ oxide overcoats. Structural analysis of the thin oxide films found the cubic phase to be dominant and hence the toughening mechanism observed for the bulk ceramic would not explain the excellent mechanical properties observed.

Advances in instrumentation included a high resonant frequency (about 3kHz) force transducer (EF-03), a new optical method for measuring pitch, roll and flying height of a slider (EF-02) and a sensitive tool for measuring surface interaction forces of diamond, tungston and MnZr ferrite radiused probes with lubricated and unlubrication carbon disc surfaces. The optical approach discussed in EF-02 is cheaper than the lasar doppler vibrometer but also less sensitive.

Although avoiding the specifics of the carbon process, paper EF-06 present interesting scanning tunneling microscopic (STM) results as part of an A/B comparison which also included Raman and TEM analysis. Although sensitive to surface contaminants, the work function measurements obtained with the STM looked to be a promising area of research.

For something completely different, paper EF-12 reports on a media produced by anodic oxidation of aluminum to produce a porous coating with needle like pores into which a ferromagnetic alloy is electro-deposited. Excellent tribologic and recording performance was reported.

Session: ER
Donald R. Krahn

This poster session was a very heterogeneous collection of papers on soft magnetic material and their applications. The session was very well attended and there was a high level of interaction with the presentors. Lefakis, et al (IBM, San Jose) presented an interesting paper describing preferential surface oxidation in their FeMn films. The magnetic properties of NeFeMo as a function of various sputtering parameters were presented by Zhang, et al (Shanghai, PRC). Kamo, et al (Tohoku, Japan) presented an interesting paper on the fabrication of inductors using multi-layer amorphous films. Two papers (Kim, et al and Jeong, et al, both from University of Texas-Austin), were presented on the very interesting properties C.B. of amorphous thin films. NaKamura, et al (Hosei University, Tokyo) described the effects of adding Mn, Mo, or Cr as a third element to SiFe.

A parametric description of eddy current losses in soft magnetic materials was presented by Saita, et al (Hosei University, Tokyo). Bussiere, et al (NRC, Canada)
presented new magnetic data on pearlitic rail steel. The only electric motor paper which described the use of ferrite wedges was presented by Kaga, et al (Akita University, Japan).

There were two papers utilizing magnetic properties to make position sensors. A woven cloth-inductor was used by Yamamoto, et al Unitika, Japan). Garshelis, et al (Magnetoelastic Devices, Inc., MA) demonstrated a very clever position sensor which measured the effective permeability of a long magnetic element.

Two papers presented new current measuring schemes. Yamaguchi, et al (Tohuku, Japan) described a current sensor utilizing the skin effect. Okanuma (Iwaki, Japan) described a new bridge current sensor. Haga, et al (Tohoku, Japan) presented a new magnetic shielding structure utilizing U-shaped soft materials. The effects of stacking various amorphous transformer sheets on power losses was investigated by Matsubara, et al (Fukuoka, Japan).

Overall, this was a very successful session.

Session: GC
Sheppard Salon

This session consisted of twelve papers, all of which were presented by an author. The applications were very diverse from three dimensional formulations, integral equation applications, coupling to circuits, lightning effects on structures and loss evaluation.

There were several discussions of each paper and reflected the generally high quality of the work presented.

Session: GD
Wayne M. Saslow

Like domain formation, randomness acts to degrade and destroy ferromagnetism; this session dealt with the effects of different types of randomness. In paper GD-01, Eugene Chudnovski (Tufts University) considered the effects of random anisotropy on ferromagnets, comparing his theoretical work with experiments on the low field susceptibility, high field magnetization and the approach to saturation, as well as the field-dependence of the static correlation length measured by neutron scattering. He pointed out that ferromagnets with weak random anisotropy have an enormous susceptibility, and for this reason may have technological applications. Paper GD-02, by David Huse (ATT-Bell) discussed theory for two topics in spin glasses (system whose spins order seemingly at random, due to competing signs–or frustration–in the exchange constants): short-range correlations that may reveal themselves in neutron scattering; and a scaling theory for the unusual long-time-scale dynamics of spin glasses. Paper GD-03, By Jack Cowen (Michigan State), discussed finite size effects on the transition temperature T_g multilayer films of CuMn spin glasses. Great care went into the preparation and characterization of these multilayer films, and the resulting near-uniformity permitted a successful scaling analysis of T_g versus the film thickness L. GD-04, by Susan McKay (U. Maine at Orono), discussed a renormalization group theory of the random field model in d=3, using the Migdal-Kadanoff approach. This led to a phase transition with hybrid behavior: a discontinuous jump in the magnetization, but a power law singularity in the specific heat. For $d<2$ the ordered state does not occur at all, and for $d>3$ the magnetization does not change discontinuously. Finally, in GD-05, Dominic Ryan (McGill) discussed the phase diagram of an interesting alloy–amorphous $Fe_{92}Zr_8$–with properties that, in related systems, have often been misinterpreted. By employing both magnetization and Mossbauer measurements, one can detect not one, but two phase transitions: as the temperature is lowered, one first finds ferromagnetic order to T_c, and at a lower temperature T_{xy} the Mossbauer measurements show that the spins develop transverse components while the measurements show that the ferromagnetic components continue to grow. This has been modeled correctly in recent theories based on short-range interactions.

Session: GE
Neil Heiman

The theme of this session repeated over and over was that exchange coupling in thin magnetic films reduces Hc but increase squareness and noise. A model by Zhu and Bertram which incorporated an array of hexagonal grains with an exchange coupling parameter demonstrated these effects. A number of experimental papers supported this theme, starting with an invited talk by Tu Chen which showed excellent data that isolated grain microstructure reduced exchange coupling.

The only disagreement was whether this phenomenon is more process related or material related. Chen and co-workers showed results which indicated that process variables, particularly argon pressure and substrate temperature, can produce Pt alloys with high or low noise. Naoe et al similarly showed that process changes with the same target produced different exchange coupling and noise; and Yogi et al showed that increasing Cr underlayer thickness reduces coupling and noise in CoNiCr films. Other papers showed that materials played a role. Kawanabe and Naoe showed that Ta addition reduced noise in CoNi films. Natarajan and Murdock showed supporting data on binary Co alloys that showed material selection is critical. Shiroishi et al showed that ternary additions to CoNi and CoCr were critical; Zr and Ta reducing noise and improving corrosion resistance.

A number of papers dealt with Lorentz microscopy where combining Foucault and Fresnel techniques reveals additional information. Alexopoulis

et al were able to observe side fringing patterns from asymmetric thin film heads. Ferrier et al were able to correlate Lorentz data to noise model in a.c. erased media. Nguyen was able to map the ripple at edges of tracks. Melas et al showed data that the use of dibits was better for noise studies than CW.

A paper by Chen et al showed glass substrates provided better glide, noise, Hc, squareness, and tribological properties but needed to be used in sector servo or with thin film heads to avoid cross talk.

Session: GF
Celia E. Yeack-Scranton

The critical importance of understanding HDI at very close spacings continues to be evident through the mix of papers aimed at better tools and better theoretical understanding.

Four papers described novel and improved measurement schemes. GF-01 (Hannon et al, IBM) described a new type of asperity detector which measures localized heating caused by asperity contact, fabricated by depositing a thin film of niobium on the back of the slider. The radial resolution can be tailored between 5 μm and a railwidth, making possible tradeoffs between localization and throughput. GF-03 (Zhu et al, Berkeley) and GF-05 (Reiner et al, UCSD) described optical interferometric means of measuring head-to-disk spacing. The two papers differed significantly in approach, but the aim of each was to increase the accuracy of the spacing measurement by referencing to the disk itself. In particular, a 2.5 nm resolution with a 40 KHz bandwidth was achieved in GF-03. The advanced instrumentation shown in GF-02 (Jefferson, IBM) included a servo-controlled head which could be positioned above a spinning disk with variable spacings down to 100 nm at 16.6 m/sec. Data included rolloff curves taken at variable spacings and constant velocity which clearly exhibited gap nulls and finite pole tip effects.

Sophisticated sensors were applied to several phenomena of critical interest in HDI. In GF-04 (Yamada and Bogy, Berkeley) the onset of an air bearing was measured during the load-unload process, and was found to occur at about 4 μm above a 5.25" disk spinning at 3600 rpm. No head-disk contacts were observed in the process. This required a Laser Doppler Vibrometer with an unusually large dynamic range and band-width. In GF-06 (Best et al, IBM), capacitively measured slider dynamics were shown to differ significantly with predictions from the Reynold's equation for rough disks at low velocities, emphasizing the need for better theoretical descriptions of air bearing roughness. Nonrepeatable spindle runout was the subject of GF-10 (Richter and Talke, UCSD), and a detailed breakdown of bearing defects and resulting non-repeatable runout frequencies was given for 5.25" files. In GF-11 (Wallash, IBM), PZT sensors on the slider were used to generate as well as to sense stress waves in sliders, allowing simulation of contact signals.

Better theoretical descriptions of air bearing behavior at very close head-disk spacings dominated the theoretical part of this session. Fukui and Keneko (GF-07, NTT) used a modified Boltzmann approach and found that for the current submicron fly heights, the results agreed with the Reynold's equation to within 10%, but for very close spacings, the results differed by greater than 20%. In GF-08 (Ruiz and Bogy, UC Berkeley) the modified Boltzmann approach described in FG-07, first and second order corrections to the continuum non-slip Reynold's equation (Burgdorfer and Hsia, respectively), and the continuum model were all compared. The discussion included a cogent view of the factors which may make a particular model more accurate for a particular slider design. A related topic was addressed in FG-09 (White, Santa Clara University), in which an air bearing model which incorporates head-disk contact was discussed. Finally, a substantial improvement in modeling tape flying characteristics was reported in FG-12, in which the inclusion of in-plane stresses allowed better representation of the boundary conditions and reduced the number of iterations in the computation.

Session: GP
C.-J. Lin

Ten papers were presented in this poster session. Most papers dealt with the preparation and characterization of the magneto-optic films.

Five papers reported the effects of sputtering conditions on the properties of magneto-optic films. St. U Schittny et al discussed the influence of target production techniques on the target properties, the sputtering processes, and the resultant films. E.

Schulthei et al presented the effects of the metallurgical structure of targets on the properties of the sputtered films, especially the composition uniformity. T. K. Hatwar et al addressed the effect of argon sputtering pressure on the magnetic properties an the morphology of TbFeCo films. A. Schone-Warnefeld et al reported the optimized preparation conditions for rf co-sputtered TbFeCo films. C. E. Davies discussed the effect of sputter-deposition conditions on the coercive force of rare-earth-rich GdTbFeCo films.

Two papers are on the characterization of TbFeCo films. M. K. Haynes et al presented an easy way of determining the magneto-optic constants from accurate measurements of the polar Kerr rotation of a series of films of different thickness. S. Yumoto et al reported an anomalous magneto-resistance effect which they have attributed to dispersed magnetic moment of Tb.

R. S. Weng et al reported their measurement of domain wall mobility in marious GdTbFeCo alloys at temperatures from 50 to 200° C using the dynamic bubble-collapsing method. M. Sekiya et al presented the effect of Ti an In_2O_3 layers on the stability of TbFeCo films on polycarbonate substrates. J. Colineau et al presented an analysis of double-layer garnet interaction in a parallel high-density magneto-optic read head.

Session: GQ
S. M. Hanna

Monolithic devices with nonreciprocal characteristics in the microwave and millimeter wave frequency ranges are of importance to many high frequency systems. Several papers in this poster session dealt with techniques to grow ferrite films of different substrates and the characterization of ferrite (film or bulk) samples.

Talisa et al, reported on the low temperature (<100°C) growth of polycrystalline ferrite thin films. In particular they reported on the growth of Ni-Zn ferrite films by the spraying of aqueous solutions on spinning substrates. The accurate control of the growth temperature (between 90°C and 100°C) is an important factor in this spin-spray technique. The spinel phase of the Ni-Zn ferrite was confirmed by their x-ray diffraction measurements. The magnetic properties of thin films (saturation magnetization, resonance linewidth, and the gyromagnetic ratio) were characterized using the FMR technique. The analysis revealed poor magnetic characteristics of films grown on glass but good ones for films grown on gold-on-GaAs and Si substrates.

Zagine and Mage's paper also dealt with the deposition and characterization of ferrite films. In this work, films of garnets, lithium ferrites and barium hexaferrites were deposited by RF sputtering followed by careful annealing in oxygen atmosphere. Different substrates have been used including silicon, alumina and metalized alumina. Another paper from the same laboratory (Thomson-CSF) was authored by Laberie, Mage and Ganne. This paper reported on an experimental technique to measure the effective line width (ΔH_{eff}) in the millimeter wave frequency range for ferrite materials. Specifically, they investigated strontium and barium hexaferrites at 94 GHz. In order to compare their measurement technique with the conventional cavity technique, measurements for substituted yttrium iron garnets were carried at 10 GHz.

W. Huizong and L. Guodong studied the magnetic properties ($4\pi M$, Hc, ΔH, etc.) of bulk samples of $Li_{0.44}\ Me_{0.12}(MgTi)_xFe_{2.44-2x}O_4$; (Me=Ni, Mn and Zn) for different compositions and at different temperatures and frequencies. Kakuno used an FMR spectroscrometer to study the direction dependence of resonant transmission of microwave radiation along the surface of Fe-Si-B foils at X-band frequencies. Kojoukharoff et al proposed an experimental-statistical method to study the composition properties relations for multicomponent YIG.

Session: HA
J. F. Cochran

Invited papers by A. S. Arrott and B. Heinrich and by F. Schwabl provided comprehensive, interesting, and excellent reviews of the dynamic behavior of real magnets for temperatures near the Curie temperature.

A paper by G. Dewar discussed the interconversion of GigaHertz sound and electromagnetic waves propagating in a ferromagnetic metal.

D. J. Lockwood and M. G. Cottam studied the Raman scattering from phonons in FeF_2 and MnF_2 in order to evaluate the spin-phonon coupling mechanism.

R. W. Gerling, D. P. Landau, and M. S. S. Challa have calculated the scattering function for

the classical xy-chain as a function of temperature and magnetic field. They obtained soliton contributions, magnon contributions, and two-magnon contributions.

Session: HB
Robert Cochrane

Five papers were presented on different aspects of the magnetism of alloys and compounds. Magnetization and Mossbauer measurements of Fe substituted $CuRh_2Se_4$ spinels indicate that Fe occupies tetrahedral sites and interacts antiferromagnetically via long-range superexchange. Neurtron diffraction studies of Cr(0.5% V) and GdSc alloys examine their critical behavior. In the former, 0.5% V changes the first order antiferromagnetic transition at 260K to a second order one. In the latter, two multicritical points around the critical Sc concentration(30%) are reported and discussed in terms of the ferromagnetic, canted and helimagnetic phases. In one of the most interesting papers of the session, it was shown that the (GdEr) Al_2 alloys form a suitable system for low temperature magnetic refrigeration via adiabatic demagnetization. The 6% Gd alloy discussed in detail demonstrates a cooling of 12K starting from 30K and a field of 8T. Finally, rare-earth copper intermetalics were examined with thermal expansion and A.C. susceptibility measurements and only in the case of TbCu does a structural transition (cubic to tetragonal) accompany the magnetic ordering.

Session: HC
Salvador H. Talisa

The first was an invited paper, an overview of "Microwave Magnetic Thin Film Devices" by Dennis Webb from the Naval Research Laboratory. Several very interesting devices were discussed, the magnetostatic wave (MSW) channelizer and the lumped-element circulator being, in my opinion, the most promising of those reviewed. Paper HC-02 dealt with the possible application of MSWs to rotation rate sensing. The next paper discussed the application of MSW resonators to filter banks. This is a promising approach and the results presented demonstrated this fact, although more work needs to be done. In paper HC-04 the author presented a new and promising technique for calculating the MSW propagation loss in multiple layered YIG films. Paper HC-05 reported on the increased MSW propagation loss resulting from the film-substrate transient layer in epitaxial YIG-on- GGG films and that resulting from the GGG substrate alone. The next two scheduled papers were not presented. The session resumed its course with paper HC-08 which dealt with a study of the MSW-light interaction in YIG films in which, through a nonlinear process apparently triggered by a local nonuniform bias field, resulted in unexpected high diffraction efficiency over more than 1GHz. The following paper dealt with the interaction between magnetostatic and surface-acoustic waves in garnet films through the magneto-elastic effect. Potential applications of this effect are similar to those of acousto-optics, with the advantage of a simpler device structure because no focusing lenses are needed. In the next paper, HC-10, the amplification of magnetoelastic surface waves in a garnet half-space was discussed, due to drifting carriers in an adjacent semiconducting film sandwiched between the garnet and a perfect conductor. In paper HC-11 the authors demonstrated the use of quasi-optical techniques to successfully develop nonreciprocal devices, such as isolators and circulators, for the 26-to-40 GHz(Ka) band. The next paper dealt with the analysis and optimization, using CAD techniques, of WYE circulators. Paper HC-13 was not presented.

Session: HD
Jeffrey O. Willis

Ten contributed papers were presented in Session HD, Applied Superconductivity. Sherwood of AT&T Bell Labs, New Jersey reported on silver clad Y-Ba-Cu-O wires (metal clad composites) and higher critical current density (217,000 A cm^{-2} at 77 K) rods that were prepared by directional solidification. Workers at Tohoku University, Sendai, Japan reported on La substitutions for Y in Y-Ba-Cu-0. For up to 30% La for Y the material remains a superconductor, but for higher concentrations, semiconducting behavior results. Goldfarb of NBS-Boulder, Colorado reported on ac susceptibility results on sintered Bi-Sr-Ca-Cu-O. No peak in γ'' indicates almost zero coupling between the grains yet a full shielding response and zero resistance is observed. The results suggest the grain boundaries are not lossy. This is quite different from the results on Y-Ba-Cu-O and implies differences in the (poor) coupling between grains for these two systems. Flipper from duPont, Wilmington, Delaware reported on ac susceptibility

measurement on high T_c materials. They observe an inverse dependence of the transition width on particle size that they ascribe to penetration depth effects. Other papers on bulk materials include a Mossbauer study of Fe in Ho-Ba-Cu-O and a study of rapidly solidified Y-, Dy-, and Er-Ba-Cu-O. Two theoretical papers dealt with modeling of magnetization critical current densities and with off-site Cooper pairing in strong electron-phonon coupled systems as a model for high T_c superconductors. Luborsky of GE, Schenectady, New York reported on sputtering of Y-Ba-Cu-O on single crystal strontium titanate. Film compositions were always slightly different from starting single target stoichiometries. On (100) substrates the films were oriented with their c axis perpendicular to the substrate. Properties were independent of thickness from 0.1 to 0.3 μm; above this value the c-axis orientation began to vanish. Critical current densities, transport or magnetization, were typically 9×10^5 A cm^{-2} at 77 K. For films deposited on (110) strontium titanite had the c axis in the film plane and x100 smaller critical current densities. Workers from Nihon University, Chiba, Japan reported on a 3-oxide target, low substrate temperature sputtering system for Y-Ba-Sr-Cu-O films on magnesia (100) substrates. It was possible to grow the films at 500°C and post anneal at 450°C in oxygen and obtain superconductivity above 77 K. Strontium additions proved detrimental to producing good films.

Session: HE
Michael Mallary

The session opened with two excellent papers from MPI and Hitachi which described the fabrication of thin film head laminated poles. Both presentations showed pictures of the poles that demonstrated the type of essentially single domain structure that is the goal of this approach (for Barkhausen noise suppression and good frequency response). The Hitachi poles were a quaternary alloys in Ni-Fe-Co-Pd while the MPI poles were Fe-Co-X. The Cobalt raises the anisotropy and saturation magnetization while the extra element reduces coercivity (and corrosion in the case of Pd).

Problems associated with large arrays of heads were dealt with in talks from Bull Peripherals and Schlumberger. A lot of good theory and experimentation on fringing effects was presented by four speakers. In a presentation from MPI the use of ferrofluid to decorate tracks was described and the relation between write width, current and frequency was discussed. A one micron wide discrete track was used as a probe of the head response as a function of off track displacement in a talk from IBM. The presentation from NTT described the use of ion milling at the air bearing surface to produce 2.5 micron track width heads that worked well. Micro-loop head field measurements from HP were also reported that spanned the width of a head.

There were two presentations from Kodak. One described the creation of spurious writes and erases by the presence of stray fields during write. The other reported "anomalous" loss of head efficiency at high frequency that could not be explained by eddy currents. Finally, there was a presentation from Siemens on the experimental and theoretical optimization of gap and pole dimensions.

Session: HF
M. P. Sharrock

As in past conferences, this session demonstrated the continuing vitality of particulate media technology. Barium ferrite particles, especially, were a subject of strong interest and were the focus of about half of the session.

In an invited paper, D. E. Speliotis presented magnetic data and recording results for a variety of barium ferrite media and found the best ones to be competitive with metal particles. He argued that record demagnetization, not self-demagnetization, is the limiting factor in high-density recording and that the large anisotropy fields, rectangular hysteresis loops, and very angle-dependent remanent coercivity values of barium ferrite are responsible for its outstanding recording properties.

M. P. Sharrock compared the demagnetization behavior of barium ferrite with that of acicular particles over a broad range of orientation parameters. In oriented media, barium ferrite was found to be more resistant to demagnetization by transverse fields than are the acidular materials. In all cases, barium ferrite has a very narrow switching-field distribution.

O. Kubo, (co-authors T. Nomura, T. Ido, and H. Yokoyama) described the use of tin substitution in barium ferrite to reduce the dependence of coercivity on temperature. Other desirable properties were not affected by the substitution.

A. R. Corradi (co-authors D. E. Speliotis, A. H. Morrish, Q. A. Parkhurst, X. Y. Zhou, G. Bottoni, D. Candolfo, A. Cecchetti, and F. Masoli) described the change of magnetic properties in barium ferrite with the substitution of iron by cobalt and titanium. It was found that substitution causes switching to become less coherent, and the authors proposed an interruption of the exchange interaction as the cause.

A. Paoluzi (co-author G. Turilli) discussed measurements of the anisotropy field of barium ferrite samples having various amounts of substituted cobalt and titanium. The ratios of anisotropy field to coercivity led to the conclusion that the magnetization reversal does not occur by coherent rotation.

R. G. Simmons (co-author D. K. Lee) discussed barium ferrite and cobalt-containing acicular oxides as candidates for high-density data storage. The signal and noise behavior of the two materials were compared, especially with regard to the possible effects of narrow switching-field distribution and particle stacking in barium ferrite.

A. E. Berkowitz (co-authors F. E. Parker, E. L. Hall, and G. Podolsky) considered alternative models for the increase in coercivity in acicular iron oxides due to the addition of cobalt. The suggested interpretation is an exchange coupling of the particle core to a high-anisotropy ferrite-like surface layer.

Y. K. Hong (co-author N. P. Hur) described several factors important in the production of acicular iron particles. These included the oxidation rate of the initial Fe $(OH)_2$ particle, the reduction time and temperature, and the use of silica coating.

E. Schwab (co-authors M. Hitzfeld and R. J. Veitch) described an investigation into the origin of coercivity changes with aging in cobalt-modified iron oxides. The results presented exclude the oxidation of Fe(II) ions as a cause; instead the authors proposed a magnetic annealing process related to the local magnetic environment.

S. Schultz (co-author C. Salling) discussed a search for amore realistic Preisach distribution, as a result of finding that minor hysteresis loops, recorded between the same field extrema but at different magnetization values, are not congruent.

S. B. Oseroff (co-authors V. M. Tobin, S. Schultz, and C. H. Chan) reported on magnetization time-decay experiments at temperatures down to 1.6 K. The data agree reasonably well with a model proposed by S. Charap that uses a distribution of anisotropy properties. The magnetization decay rate is found to approach zero as temperature approaches zero, so that the decay is seen to be by thermal activation and not by quantum tunneling.

Session: HR

David J. Sellmyer

In general terms the session consisted of papers in three classes: (1) magnetic properties and microstructure of some of the rare-earth-transition metal phases of interest for hard magnet applications, (2) intrinsic and extrinsic properties of ferrite magnets, and (3) a variety of studies involving design of permanent-magnet structures and field configurations for specific applications. Saito et al and Yang et al reported on rapidly quenched $SmTiFe_{11}$ and $Y(ti,Fe)_{12}$ alloys respectively. These newly discovered alloys have the tetragonal $ThMn_{12}$ structure with reasonably high coercivity and energy products. Exploratory work on as-cast Nd-Fe-Ti alloys was reported by the group of Hadjipanayis. Theremomagnetic studies and electron microscopy were used to identify some of the phases present, including Nd_2Fe_{17}, among others. Rapid quenching from the melt on $(FeCo)_5Sm$ and $(FeCo)_7Sm_2$ alloy systems was reported by Miyazaki et al. Studies as a function of quench rate (wheel speed) showed variable concentrations of 17:2, 5:1, 7:2, and 3:1 phases. Mukai et al showed that adding small amounts of boron to Sm_2Co_{17} type phases was effective in suppressing precipitation of the 2:7 phase and thus in increasing the coercivity to 14 kOe. The second group of papers (on ferrites) included those of Hopstock who studied the relationship of the degree of alignment in barium ferrite and the hysteretic properties in bonded magnets; Richter and Hempel who studied magnetic interactions in chemically co-precipitated barium ferrite; Schumacher et al who studied the angular dependence of the critical field of barium ferrite with remanence and microwave measurements; and Collomb et al who studied in detail with neutron diffraction and magnetic measurements the magnetic structures, easy axis reorientation,

anisotropy constants as a function of temperature for the W-type hexagonal ferrite: $BaCo_2Fe_{16}O_{27}$. The third group of papers included a set of four by Leupold and co-workers who have investigated a variety of novel field-shaping arrangments for applications including NMR imagers, Fraaday rotation, motors, free-electron lasers, inter alia. Finally, Lee and Furlani reported on mathematical modeling to optimize multipole magnetizing fixtures for high energy magnets, and Lemarquard and Yonnet reported on design and measured characteristics of two different types of magnetic bearings.

Session: JB
Gordon E. Fish

The papers in Session JB, Amorphous Materials and Applications, reflected the growing sophistication in the use of these materials in other than line frequency devices. Papers by C. H. Smith (Allied-Signal) and M. R. J. Gibbs (University of Bath) described properties of metalic glasses for use in saturable reactors for high power, high speed pulse compression and switching. Co-based, zero magnetostriction, materials were studied by Yamaguchi et al (Tohoku University), who reported high frequency reset characteristics, and by Yagi et al (Miyagi College of Technology), who studied ribbons as thin as 6 μm. Novel Fe-based alloys, with properties comparable to those of Co-based materials, were announced by Yoshizawa (Hitachi Metals), who described the effect of a nano-crystalline microstructure.

Thin-film production was reported by Wallace (Xi Magnetics) for FeBSi and by Childress et al (Johns Hopkins University) for metastable body-centered cubic 304 stainless steel. Lupi (University of Padua) reported a 1500 kVA, medium frequency (10kHz) transformer design study and prototype and Murakami (Wacom Company) described an amorphous wire-based magnetic position digitizer. Celasco et al (Institute Galileo Ferraris) discussed on-going work on Barkhausen noise as a source of magnetic after effects.

Session: JE
Gordon Hughes, Seagate

This session covered various recording topics. Paper JE-01 from HP discussed many of the interesting time domain recording measurements that don't have frequency domain counterparts, such as time interval analysis measurements of pulse pairing and gaussian noise, phase lock loop offset deconvolution from phase margin graphs, and time domain overwrite measurements. In JE-03, IBM announced their "747" track misregistry curve originally developed in 1978, which plots the maximum offtrack possible versus adjacent track spacing. JE-05 from IBM Yorktown, presented an interesting linear actuator utilizing air squeeze bearings formed by piezoelectric excitation, with only 11 grams of moving mass. JE-07 proposed adjusting the servo writers for disc drives having double track width servo heads, to compensate for servo head width tolerance by writing wide or narrow servo tracks, so that servo write plus read width stays constant. In JE-08, Kodak took a digital streamer tape/head interface to an extreme recording density of 107kbpi and 16um track width, using super VHS tape media (840 Oe,1370G Br), and compact spectrum (1,7) recording, with an unshielded magnetoresistive read head. CSR has no intersymbol interference, and no dc to saturate the MR head. JE-12 discussed the performance of optimum playback detection schemes, in the presence of offtrack noise. Conclusion: partial response PR4 is best and 1-D is almost as good. Conventional peak detection is considerably worse.

Session: JP
Eric Katz

There were a number of measurement techniques described for studying the mechanism of the magnetization reversal process in perpendicular recording media.

Webb and Schultz of UCSD reported on a technique for measuring the dynamics of the magnetization reversal process in CoCr films with a well-defined columnar structure, at a microscopic level, using the anamalous Hall effect. With this method, they were easily able to see the effects of domain switching for CoCr films whose single column diameters range from 100 to 1000 A. They showed that in the presence of an applied field, magnetization reversal occurs primarily by uncorrelated switching of individual columns.

K. Ouchi and S.-I Iwasaki described a technique for studying the reversal process in CoCr films on a macroscopic level. They used a VSM with two sets of sense coils, one detecting M parallel to the

applied field, the second set oriented to detect M perpendicular to this direction. In so doing, they are able to correct for the large sheet demagnetizing effects occuring throughout the determination of the hysteresis loops. Measurements were performed varying the angle between the direction of the applied field and the direction of the normal to the film. For the high Hc films used in this study, they found their results to be compatible with a curling model for the reversal mechanism, rather than a domain wall motion mechanism.

Y. Maeda and M. Takahashi of NTT described an investigation of the microstructure in CoCr films using an aqua regia etch. This study is an extension of Maeda's earlier work in TEM imaging of Cr micro-segregation within CoCr films. For this study, the characteristic CP-structure was evaluated as a function of the film thickness, which ranged from 530 A to 4.1 μm. A CP structure growth model was presented based upon phase separation and grain boundary Cr enrichment. At the latter stages of segregation, the individual grains appear as "frog eggs" where Co-rich rings surround Cr-rich cores.

There were a number of papers describing various methods of preparing perpendicular recording media, as well as some of the resultant properties. Y. Hoshi and N. Naoe described the magnetic properties of CoCr films sputter deposited in an opposing target apparatus, where the substrate was tilted in order to effect different angles of incident deposition. They found magnetic properties to be relatively insensitive to deposition angle from normal to 45 degrees. Beyond 50 degrees, c-axis orientation deteriorates significantly, and the resultant magnetic properties are likewise affected.

A. Morisako et al described their studies of reactively sputtered Ba-ferrite thin films deposited at different oxygen partial pressures. Two distinct crystal phases were identified, where their presence was highly dependent upon the oxygen partial pressure during sputtering. Film magnetic properties were also shown as a function of oxygen partial pressure.

H. Matsubara et al described details of a double layer media (Ni Mo P underlayer, used as an initial layer, with epitaxially-grown Co Mo Re P), which are both electroless plated on a two mil polyimide substrate. Magnetic recording measurements of these disks, using ring heads with an 8 u" gap in contact with the media (flexible disk format) exhibited response in excess of 200 KFCI.

Also described by Y. Satoh et al was a perpendicular particulate tape media, using needle-shaped iron particles as the magnetic material. The intended application of this medium was 8 mm format video tape.

This reviewer would like to acknowledge the assistance of Dr. Chandler Baldwin in preparing this session review.

Session: KC
F. J. Friedlaender

There were twelve papers presented in this session.

The first three papers by authors from Hitachi, NEC and Kyushu University discussed various aspects of vertical Bloch Line memories. In the Hitachi paper, Block line propagation was demonstrated in a field-access scheme which was described in detail. A joint paper by NEC and Kyushu University described a grooved structure for stable multidomain generation and reliable gate operation. Pulsed bias fields were used to propagate vertical Bloch lines in a ring-shaped, grooved structure made by NEC as described in the third paper.

Papers four and five, by Kyushu University and Tokyo University of Electro-Communications, respectively, used computer simulations/programs to investigate VBLs, wall merging, read operations in the first and three dimensional calculations of VBLs and Bloch points in the second paper. A Sony paper dealt with an experimental topic, chopping of stripe domains for VBL replication, and conclusions were drawn on methods to obtain error-free replication. A paper presented by the LETI group (Grenoble) described relations between VBL displacement and wall motion, using direct VBL observation by means previously described by them. A University of Wuppertal paper also reported on the direct optical observation of VBLs, including the determination of their twist and charge. There were papers on high sensitivity detection of domain wall resonance (Le Gall and Vukadinovic) and resonance effects observed in bubbles moving in a circular trajectory and having different wall states (Purdue University). The last paper (MemTech) discussed bubble memory performance under adverse conditions (simulated severe transient radiation).

Session: KF
Dean Palmer

The first four papers dealt with overwrite and the measurement of the bit shift due to overwrite. The first method (Tsang and Tang) uses the spectral analysis of the intermodualtion components of two square wave patterns. The second (Palmer et al) involves the analysis of signals generated by a pseudorandom sequence. The first method offers simplicity; the second provides the simultaneous measurement of other nonlinear effects.

A self-consistent magnetization model of the overwrite process was presented (Roscamp and Curland) which showed that timing modulation dominates at high write fields while amplitude modulation holds for lower fields.

An experimental study of Ba-ferrite media (Yamamori and Tanaka) resulted in the conclusion that the overwrite is due to peak shift in saturation recording and that both peak shift and extra-bit generation are present for partial-penetration.

The first of two papers on sawtooth transitions (Middleton et al) provides a prediction of the transition length that turns out to be very close to that derived from conventional arctangent theory.

The subject of the second paper (Tang) was a formula relating the transition noise and signal in terms of the statistical distributions of the sawtooth geometry.

A magnetization model (Victora and Peng) was applied to Ba-ferrite media to obtain signal and noise levels which agreed very closely with experiment.

The asymmetry of the modulation noise spectra of tape media gives information on the separation distance, the effective recording depth, and the noise mechanism (Cramer et al). Experiment results at medium wavelengths suggest that the modulation is not caused by surface related effects alone.

The final paper (Monson) examined the differences in the fringing fields of perpendicular and longitudinal transitions. The fringe field from the longitudinal media loses both amplitude and resolution with increased distance from the track centerline, but the field from the perpendicular media also changes shape.

Session: KP
Jiin-chuan Wu

In paper KP-01, N. Hayashi, et al, solved the Gilbert equation for the one-dimensional Neel and Bloch walls in a thin permalloy film using three different numerical methods, namely, Euler, modified Dufort-Frankel and backward Euler methods. Their results show that the backward Euler method is the most stable method. This method was used, in two-dimensions, to solve for the closure domain pattern in a rectangular thin permalloy film.

In paper KP-02, M. Alex, et al, developed a computer simulator to model the operation of current-activated gates used in ion-implanted magnetic bubble devices. The simulator included the models for ion-implanted pattern, magnetic characteristics of the bubble film, overlay conductor geometry and domain wall motion. The operation of a trapping transfer gate, a dual conductor block replicator gate and the propagation on ion-implanted patterns were simulated. The simulated bias margins correspond well with experimental ones.

In paper KP-03, T. Toyooka, et al, described a 16 Mbit bubble memory chip using permalloy patterns for minor loop storage area and ion-implanted tracks for major line. A bubble generator formed by two level conductor was used to avoid generating extra bubbles. A two level conductor bubble stretcher design was used to avoid bipolar drive. A dual gate which performs pseudo swap and replicate function is employed between minor loop and major line. The overall bias margin for this chip is 7.8%.

In paper KP-04, A. V. Pohm, et al, designed a 1 Mbit chip using 1.5 x 5 microms M-R double layer memory elements and bipolar circuitry. The bipolar circuitry is based on nominal 1.25 μm optical lithography. The total chip area of the design is 8.5 x 9.5 mm. Multiple reads were used with the non-destructive readout cells to enhance the signal to noise ratio. Design read and write times are 3 and 0.2 microseconds, respectively.

In paper KP-05, T. Dupuis, et al, fabricated a 4 Kbit RAM using the M-R double layer memory elements described in paper KP-04. The memory cell size is 1.8 x 18 μm. The memory is organized as 4K by 1 bits; die size is 180 x 120 mil. It uses a single 5 V power supply; operating temperature, ranges from -55 to 125 degrees C; read time is 900 nsec; write time is 150 nsec. The total power dissipation is 77 mW in standby mode, and 142 mW in active mode. The output voltage is TTL compatible.

CONGRESS OFFERS FUNDS TO UPGRADE UNIVERSITY RESEARCH FACILITIES

The two-year budget authorization for the NSF is moving forward despite election-year shenanigans that include a non-relevant rider tacked to the House bill requiring a "drug-free work place." The "drug-free" amendment, which has been appended to several other authorization bills, says money appropriated under the bills cannot be spent "in any workplace that is not free of illegal use or possession of drugs." So great is the drug hysteria that members are afraid to fight it in an election year.

H.R. 4418 was reported by the House Science & Technology Committee on May 24, (H.R. Rept. 100-649). The bill authorizes $85 million and $120 million more than requested for FYs 1989 and 1990 and designates the money for academic research facilities, which are described as "crumbling buildings, obsolete equipment, and faculty shortages..."

Members of the House panel have been concerned in recent years by the deterioration in academic research facilities. A 1986 report of the White House Science Council estimated educational facility needs at $100 billion over ten years. The Council recommended creation of a facilities fund in NSF and adjustment of the indirect cost allowance. As set out in H.R. 4418, the NSF will make matching competitive grants to colleges and universities, independent nonprofit research institutions and research museums for repair, renovation, or replacement of obsolete labs and other research facilities. Awards cannot exceed $5 million to any institution over any five-year period. In response to complaints from small colleges and specialized institutions, the Committee directed that 15% of the funds be given to institutions that receive under $10 million in Federal R&D funds.

U.S. URGED TO SPEED UP EFFORTS TO COMMERCIALIZE SUPERCONDUCTIVITY

The Office of Technology Assessment (OTA) has told Congress that the U.S. must revise its strategy if it is not to lag behind in achieving the rewards of successful commercialization of High Temperature Superconductivity (HTS). The OTA message (a 171-page report dated June 1988) is that unless government policies are re-directed and industry strategy re-examined, the U.S. will lose this major technical and economic race.

OTA also believes U.S. ability to compete internationally will be aided via increased support for the education of scientists and engineers. The U.S. should also set up a new Federal agency charged with supporting commercial technologies.

1988 WILLIAM E. NEWELL POWER ELECTRONICS AWARD

Dr. Koosuke Harada is this years winner of the William E. Newell Power Electronics Award.

Dr. Harada joined the faculty of the Department of Electronics of Kyushu University in 1960 as Associate Professor and he has held the rank of Professor since 1968. He is an active researcher in the fields of power electronics, nonlinear magnetics, magnetic sensors, reliability engineering and biomagnetics. At Kyushu University he created and supervises an extensive teaching and research program in these areas, with particular emphasis in power electronics.

Dr. Harada has published over fifty papers in IEEE publications, most of which are in the field of power electronics, and has been awarded more than thirty patents. He has developed a number of new topologies for converters and inverters and clarified analytically various important phenomena in these circuits. In the field of magnetic amplifiers, Dr. Harada has made contributions since the early 1950s, recently developing high-frequency applications using amorphous-material magnetic cores. In 1976 he presented the concept of the cascade connection between switching regulators. In the early part of this decade he disclosed new topologies for PWM converters operating in the megahertz range. He has been active in the analysis of switching noise by use of high-frequency equivalent circuits, and through this analytical work established design principles for snubber circuits. Recently, he reported on a method of regulating the resonant converter when operating at a constant frequency. Dr. Harada has also been involved in research on ferroresonance and the constant-voltage transformer. In other allied fields of interest, he has developed magnetic sensors for detecting distored currents, magnetic field strength and shaft torque, and has investigated interactions between magnetics and biology.

NOTE (Continued from page 10)

publish in the next issue. I also tried to get summaries from the recent ICM conference in Paris, but to no avail. Ed Della Torre was kind enough to share his view of the conference.

One suggestion I received for the Newsletter is to publish summaries from universities on their research in magnetics. This strikes me as a good idea. Is anyone interested? If we do this, I'd like to hear from schools both in and out of the United States. After all, we are an international organization.

You may notice that I have made some changes in the appearance of this issue of the Newsletter. What do you think?

INTERMAG '89 CONFERENCE

The International Magnetics Conference, sponsored by the Magnetics Society of the IEEE, will be held at the Mayflower Hotel in Washington, DC, USA from Tuesday, March 28, 1989 to Friday, March 31, 1989.

The purpose of the International Magnetics Conference is to provide a forum for presentation of new developments in applied magnetics, related magnetic phenomena, and information storage techniques. In addition to the contributed papers, there will be invited papers, sessions wherein competing technologies can be assessed, tutorial sessions, and workshops for less formal discussion of timely and/or controversial topics. Special emphasis will be placed on applications oriented topics in the above, as well as in the contributed papers.

Contributed papers are solicited in all areas of applied magnetics, related magnetic phenomena, and information storage technologies. Topics of wide interest in recent years have included all aspects of magnetic recording, various magnetic and other memory technologies, microwave magnetics, transformers, permanent magnet materials and technologies, magnetic control and power conversion and conditioning, magnetometry and transducers, magnetic gradient separation, magnetic field calculations, magnetics in life sciences, and magnetic materials properties and processing. In addition, papers on superconductors (materials, devices, applications, and theory) are solicited for this conference. This list is intended to be suggestive rather than restrictive.

The Conference Reception will be held at the Navy Museum at the Washington Navy Yard. This is a fascinating museum with many interesting exhibits and displays. Non-military groups are rarely granted use of this museum.

The conference takes place the week after Easter, which will be a busy and, hopefully, beautiful time in the nation's capital since Washington will be hosting the annual Cherry Blossom Festival. Early hotel reservations are strongly encouraged.

Individuals who are not on the conference mailing list may obtain further information from the Conference Publicity Chairman, John Nyenhuis, School of Electrical Engineering, Purdue University, West Lafayette, IN 47907 (317) 494-3524.

Persons wishing to submit a two page digest (prepared in conformity to instructions) submit before the November 7, 1988 deadline to:

INTERMAG
c/o Courtesy Associates, Inc.
655 15th St. NW, Suite 300
Washington, DC USA 20005

7th INTERNATIONAL SEMINAR ON MAGNETISM

The 7th International Seminar of Magnetism is to be held April 3-7, 1989 at Dohma near Dresden, GDR.

Scope of the conference:

- Permanent magnets - materials and application
- Theory of magnetism and micromagnetism
- Magnetism in disordered systems and spin glasses
- Magnetic measurement techniques
- Magnetic recording

For further information contact:

Prof. Dr. K. Elk
Hochschule fur Verkehrswesen
Wissenschaftsbereich Physik
Postfach 103
DDR-8072 Dresden

10th INTERNATIONAL WORKSHOP ON RARE-EARTH MAGNETS AND THEIR APPLICATIONS

The Tenth Conference in this series will take place May 17-19, 1989 at the International Conference Hall, Kyoto, Japan. Like the previous meetings, it will deal with all aspects of the rare-earth permanent magnets in three days of invited reviews, contributed papers, tutorials and discussions.

The program will include sessions on raw materials, alloy metallurgy, materials development and magnet manufacturing technology, magnet properties, applications (including those at cryogenic temperatures), as well as circuit/device design. Also covered will be the physics of anisotropy, high coercivity and giant magnetostriction. There will be an industrial product exhibition. Printed proceedings will be available at the conference.

The international community of "rare-earth magneticians" considers this conference its major forum for discussing progress and prospects in this field. The organizaing committee looks forward to the participation of engineers, materials scientists and corporate business planners. If you have been active doing new things, we invite your contribution to the technical program or the exhibition.

Those planning to attend or just wanting to keep informed should contact the organizers:

The Society of Non-Traditional Technology
Attn: Mr. T. Kurino
General Manager
Kotohiro Kaikan Bldg., 1-2-8
Toranomon, Minato-ku, Tokyo 105, Japan
(FAX (81)-3-597-0535)

Contact person in the USA is:

Prof. K. J. Strnat
Magnetics Lab, KL-365
University of Day
Dayton, OH 45469
telephone (513) 229-3535

PERPENDICULAR MAGNETIC RECORDING CONFERENCE '89

New Takanawa Prince Hotel, Tokyo, Japan
August 29-31, 1989

The purpose of this conference is to bring together scientists and engineers in the field of magnetics and other related areas who are interested in perpendicular magnetic recording and to provide an opportunity for presentations and discussions on recent advances in that field.

This conference will include topics on areas of basic and applied science related to perpendicular magnetic recording. The technical subject categores for the conference are:

- Principles and Theory
- Head (Materials and Devices)
- Media (Perpendicular and Longitudinal; Thin Film and Particulate)
- Substrate Materials and Fabrication Methods
- Microstructure and Magnetization
- Recording Characteristics
- Head–Media Interface and Tribology
- Systems and Applications
  (Coding, Signal Procesing, Equalization, Drives, Evaluation Tools and Future Trends)

For further information contact:

Prof. Masahiko Naoe
Department of Physical Electronics
Tokyo Institute of Technology
2-12-1 O-okayama, Meguro-ku,
Tokyo 15, JAPAN

7th COMPUMAG CONFERENCE TOKYO SEPTEMBER 3-7, 1989

The seventh COMPUMAG Conference on the Computation of Electromagnetic Fields will be held in Tokyo, Japan from September 3 to September 7, 1989. Its aim will be to review recent developments in the numerical computation of electromagnetic fields for physicists and engineers engaged in the design of electromagnetic devices and permanent magnets.

Topics of interest to the Conference include:

- Two and three dimensional magnetostatic and electrostatic field calculations for both linear and non-linear problems. Both new techniques and improvements to existing methods are appropriate subjects.
- Time-dependent fields, including the transient and steady state behavior of electromagnetic devices, eddy current, flux penetration into iron and equivalent circuit techniques.
- Material properties, including the numerical treatment of anisotropy, hysteresis, permanent magnets and diamagnetics.

- Electromagnetic fields coupled to a mechanical, electronic, thermal and/or flow system. Examples include medical systems, actuators, variable speed drives, superconducing magnets, electro-head, nondestructive testing, recording heads, nuclear fusion and power electronic devices.
- Numerical techniques, including mesh generation, error estimation, inverse problem, optimization and methods of solving large sets of equations with dense or sparse matrices of coefficients.
- Practical experience in the application of computer programs for the design of electromagnetic devices, with particular reference to the calculation of forces and other integral parameters.
- Software methodology and interactive computer aided design for electromagnetics. Topics of interest include graphics, parallel computation, knowledge base, expert systems and AI-techniques.

For further information contact:

COMPUMAG SECRETARIAT
Nuclear Engineering Research Lab
The Faculty of Engineering
The University of Tokyo
Tokai, Ibaraki, 319-11, Japan

SECOND INTERNATIONAL SYMPOSIUM ON TRENDS AND NEW APPLICATIONS IN THIN FILMS

Following a successful conference in Strasbourg (France) in 1987, this symposium will bring together scientists and engineers active in fundamental research and in industrial applications of thin films. Actual trends in the production, characterization and application of thin films will be illustrated in invited talks and contributed papers. In order to encourage interaction and discussion among the participants, no parallel sessions will be held.

The symposium will comprise:

- an industrial exhibition of equipment and material for film production and characterization,
- a one-day teaching program on modern film deposition and characterization techniques on Monday, February 27, 1989,
- the scientific program (Tuesday-Friday, February 28 to March 3, 1989) divided into 9 sessions including a special session devoted to industrial presentations and a panel discussion,
- a social program aimed at enhancing contacts among the participants of the symposium.

For further information contact:

Prof. Dr. H. Hoffmann
Inst. fur Angewandte Physik
Universitat Regensburg
8400 Regensburg, Fed. Rep. Germany
telephone (0) 941/943-2651

INTERNATIONAL CONFERENCE ON THE PHYSICS OF HIGHLY CORRELATED ELECTRON SYSTEMS
SEPTEMBER 11-15, 1989
SANTA FE, NEW MEXICO USA

Topics:

- Anomalous f - and d - Electron systems
- Magnetic Ordering and Correlations
- Electron Hybridization Effects
- Heavy Fermion Phenomena
- Fluctuating Valence
- Crystal Fields
- Mechanisms in High Tc and Heavy Fermion Superconductors

For further information contact:

Jeffrey O. Willis
Local Chairman
International Conference on the Physics of Highly Correlated Electron Systems
Group P-10, Mail Stop K764
Los Alamos National Laboratory
Los Alamos, NM 87545 USA

CONFERENCE CALENDAR

3rd Biennial Conference on Electromagnetic Field Computation, December 12-14, 1988 Washington, DC. For information contact Professor K. Webb, Electrical Engineering Dept., University of Maryland, College Park, MD 20742 USA

5th International Conference on Ferrites, January 10-13, 1989, Bombay, India. Contact C. M. Srivastava (convener, ICF5), Head ACRE, I.I.T., Bombay 40076 India.

2nd International Symposium on Trends and New Applications in Thin Films, February 27 - March 3, 1989, Regensburg, Fed. Rep. Germany. For information and contact see page 34.

"International Symposium on Magnetoelasticity and Electronic Structure of Transition Metals, Alloys and Films" March 20-22, 1989, Contact IOSMES '89, Dr. M. Acet, Universitat Duisburg, Postfach 10 15 03, D-4100 Duisburg 1, West Germany

INTERMAG Conference, March 28-31, 1989 Mayflower Hotel, Washington DC. For information and contact see page 32.

7th International Seminar on Magnetism, April 3-7, 1989 at Dohma near Dresden, GDR. For information and contact see page 32.

10th International Workshop on Rare-Earth Magnets and Their Applications, May 17-19, 1989, International Conference Hall, Kyoto, Japan. For further information and contact see page 33.

International Perpendicular Magnetic Recording Conference '89, August 29-31, 1989, New Takanawa Prince Hotel, Tokyo, Japan. For further information and contact see page 33.

5th International Conference on Magnetic Fluids, September 1989 Riga, Latvia (USSR). Contact Professor E. Blums, Institute of Physics, Latvian SSR Academy of Sciences, 229021 Riga, Salaspils, USSR. Cable: Riga Atom USSR, Telephone 947188 (Riga)

7th COMPUMAG Conference on the Computation of Electromagnetic Fields, September 3-7, 1989, Tokyo, Japan. For further information see page 33.

International Conference on the Physics of Highly Correlated Electron Systems, September 11-15, 1989, Santa Fe, New Mexico, USA. For further information see page 34.

International Conference on Magnetism and Magnetic Materials, December 4-6, 1989, Rimini Italy. Contact Magis International S.r.l., Via Boccaccio 19, 20123 Milano ITALY

34th Conference on Magnetism and Magnetic Materials, December 4-7, 1989 Sheraton Hotel, Boston, MA.

INTERMAG Conference, April 16-20, 1990 Metropole Hotel, Brighton, UK.

35th Magnetism and Magnetic Materials Conference, October 29-November 2, 1990 Town and Country Hotel, San Diego, CA.

IEEE MAGNETICS SOCIETY NEWSLETTER
c/o Craig Perlov
Hewlett-Packard Laboratories
MS-2U-13
P.O. Box 10490
Palo Alto, CA 94303