ICAM'93 Sets New Mark

The Third IUMRS International Conference on Advanced Materials was held August 31 to September 4 of this year in Tokyo, Japan. In the tradition of an MRS-style format, the ICAM'93 meeting was a multi-symposium, multi-topical event that drew more than 1,850 participants who presented over 2,000 papers. The conference venue in Tokyo was Sunshine City in the Ikebukuro district, where the first ICAM was held in 1988.

The number of participants and papers at ICAM'93 not only substantially exceeded those of 1988, but the conference offered 36 separate topical symposia plus an expanded Symposium X. At MRS meetings in the United States, Symposium X has traditionally been a popular cross-disciplinary lunchtime event in both Boston and San Francisco. At ICAM'93, Symposium X was a full four-day symposium spanning the Frontiers of Materials Science and Engineering with more than 50 invited talks. Themes ranged from metals and ceramics to new characterization techniques and beyond, largely representing the broad distribution of areas covered by the concurrently running topical symposia.

Perhaps the highlight of Symposium X was a lecture on "The Great Materials Network" delivered by Prof. Frederick Seitz of The Rockefeller University. It was a *tour de force* review of the historical development of what we now know as materials science and engineering.

As one of the principal rotating meetings of the International Union of Materials Research Societies, ICAM'93 also hosted a meeting of the IUMRS General Assembly with delegates from the nine Adhering Bodies from around the world. A summary of that meeting appears elsewhere in this issue.

In addition to being sponsored by IUMRS, ICAM'93 was co-organized by the host society, the Materials Research Society of Japan, which was entirely responsible for the local arrangements and implementation of the program.

The principal sponsor of ICAM'93, Nikkan Kogyo Shimbun, Ltd., a technical publishing company, also sponsored the ICAM conference held in 1988. In addition to its principal sponsor, ICAM'93 lists nearly 100 co-sponsors, which consist primarily of sister technical societies in Japan. More than 80 companies and laboratories provided additional financial support to the conference and its symposia.

Special mention should be made of the chairmen of the conference organizing committee: Masao Doyama, Shigeyuki Sōmiya, and Shigehiko Yamada (all from Nishi Tokyo University) and Masaki Hasegawa (Toin Yokohama University). They did an excellent job fitting such a large conference into the available facilities at Sunshine City. The Sunshine City physical arrangement is not unlike that encountered by attendees of the MRS Boston meeting in that the symposia were divided between two major buildings in a single complex that also included an extensive shopping mall. During the week of the conference, the IUMRS logo badge could be seen in almost every shop and restaurant within the complex.

The day before the conference, a competition was held among young scientists and engineers for awards recognizing excellence in content and presentation of a research paper. Winners received their awards, which included a cash grant of ¥30,000, during the Thursday evening conference banquet planned by the organizers for all participants.

The banquet host was Nikkan Kogyo Shimbun. Ceremonies opened with the presentation of student awards, the recognition of officers of IUMRS member societies, and the awarding of honorary membership in MRS-J to several distinguished scientists from around the world (see sidebar). The traditional part of the ceremony, characteristic of the host country, was the breaking open of sake barrels, a privilege reserved for those near the stage who were quick enough to rise to the occasion when volunteers were solicited.

Each of the 36 topical symposia was organized by several experts in the field, many of whom were researchers from outside Japan. Summaries of the symposia will appear in the *MRS-J Newsletter*; selected translations accompany this report. Proceedings of the symposia will be collected in 11 volumes and published by Elsevier Science Publishers and MRS-J. Related topics will be combined and jointly published in single books.

Materials Research Society of Japan–Honorary Members

Named at ICAM '93

R.C. DeVries (USA)
General Electric (retired)

F. Seitz (USA)
The Rockefeller University

C.X. Shi (China)
National Natural Science Foundation of China

E.N. Kaufmann (USA)
Argonne National Laboratory

J.D. MacKenzie (USA)
University of California-Los Angeles

A.C.D. Chaklader (Canada)
University of British Columbia

N. Claussen (Germany)
Technische Universität Hamburg-Harburg

J.B. MacChesney (USA)
AT&T Bell Laboratories

***D.S. Yan (China)**
Chinese Academy of Science

***L.E. Cross (USA)**
Pennsylvania State University

*Named previously, but accepting certificates at ICAM'93.

I.A. Aksay (USA)
Princeton University

H.S. Choi (Korea)
Research Institute of Industrial Science & Technology

C.M. Wayman (USA)
University of Illinois

M. Rühle (Germany)
Max-Planck-Institut für Metallforschung (Stuttgart)

H.J. Hannink (Australia)
CSIRO

R.C. Bradt (USA)
University of Nevada

R.W. Siegel (USA)
Argonne National Laboratory

M.V. Swain (Australia)
CSIRO

P. Siffert (France)
CNRS-Strasbourg

Previously Named

M.J. Murray (Australia)
CSIRO

O.C.C. Lin (Taiwan, China)
Industrial Technology Research Institute

M.C. Chon (Korea)
Chon International Co.

K.H. Kim (Korea)
Korea Advanced Institute of Science & Technology

R. Roy (USA)
Pennsylvania State University

J.A. Pask (USA)
University of California-Berkeley (Emeritus)

E. Matijevic (USA)
Clarkson University

C.N.R. Rao (India)
Indian Institute of Science

B.S. Jeon (Korea)
Kos Co.

R.P.H. Chang (USA)
Northwestern University

E.F. Osborn (USA)
Pennsylvania State University (Emeritus)

W.D. Kingery (USA)
Arizona State University

G. Petzow (Germany)
Max-Planck-Institut für Metallforschung (Stuttgart)

New honorary members of MRS-J receive plaques presented by M. Doyama and S. Sōmiya, co-organizers of ICAM'93.

Symposium Summaries—*Translated and edited from materials supplied by ICAM'93 symposium organizers.*

Composites (Symposium A)

Organizing Committee: M. Sakai, Y. Huang, L. Nicolais, S. Yamada, and E. Yasuda.

This symposium focused on the science and technology of composite materials, and more than 60 papers were presented. The symposium encompassed several interdisciplinary topics from processing and fracture mechanics evaluation of composite materials to surface treatments of reinforcing fibers and theoretical considerations of matrix/reinforcer interface problems. Although the mechanical behaviors of respective matrices of polymers, metals, and ceramics are completely different, it was emphasized throughout the symposium that approaches to solving problems and their fundamental principles are common for any composite materials of interest. A few Chinese scientists cancelled their oral presentations. This was a disappointment because the organizers had expected significant contributions from Chinese scientists to the international science community.

Ceremonial opening of sake barrels at ICAM'93 banquet.

Superplastic Phenomena in Ceramics, Intermetallics, and Composites (Symposium E)

Organizing Committee: M. Kobayashi, M. Hirohashi, R. Raj, J. Wadsworth, and F. Wakai.

Held September 3 and 4, Symposium E was supported by the Amada Foundation for Metal Working Technology, Japan, and the Research Group of Superplasticity in Japan. In the past, the concept of superplasticity dealt mainly with some special alloys but has now expanded dramatically to include many commercial alloys, ceramics, intermetallics, and composites. The forming technique utilizing superplasticity is not only expected to become a novel process for future industries, but the phenomenon also attracts attention because it is a common property of materials with a nanoscopic or mesoscopic structure. The objective of the symposium was to gather researchers from various specific materials fields to focus on rapid advances in superplastic phenomena of advanced materials. The organizers endeavored to form a basis for the future development of this field, which is still in its infancy as an industrial technology. The number of presentations in the symposium was not large (32 papers), but 40% of them came from abroad, including the invited papers by B. Baudelet and I.W. Chen. The gathering of most key people in this field initiated active discussions. The issue of a future direction for this field and the need for guiding principles became a consensus.

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Shape-Memory Materials (Symposium H)

Organizing Committee: K. Otsuka, J.V. Humbeeck, C.T. Liu, K. Shimizu, and K. Suzuki.

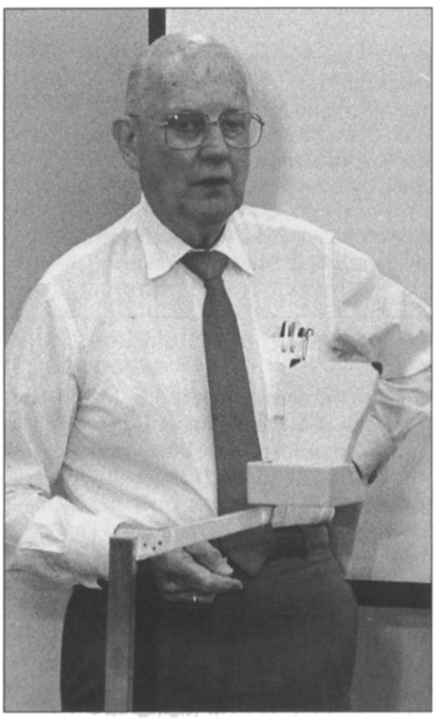
Attendees from 15 countries presented 90 papers, among which were 48 from abroad. Poster preview sessions, allowing three minutes per paper, proved to be quite popular as an efficient way to arrange these presentations. The symposium started with keynote lectures from Profs. Wayman and Khachaturyan, and covered a wide area of shape-memory materials from fundamentals, including first-principles calculations, to applications of shape-memory alloys. It was useful to show the recent developments in this area. Among many interesting topics were papers on Ni-Al (including Ni-Al-Mn), high-temperature shape-memory alloys, including Ti-Pd-X (X = Cr, Ni, etc.) and Ti-Ni-Zr, and Ti-Ni thin films, and they attracted much attention. Applications of shape-memory alloys in Japan, the United States, and Europe were also described.

S. Sōmiya (co-organizer of ICAM'93, vice president of MRS-J, and treasurer of IUMRS) is flanked by hostesses as he addresses ICAM'93 banquet.

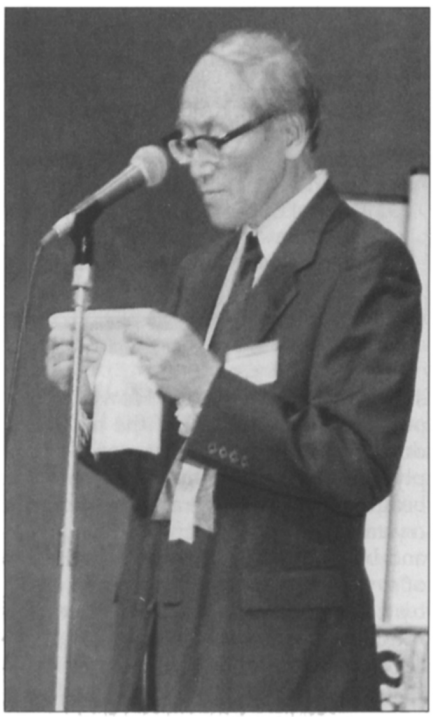
Hydrogen-Absorbing Materials and Hydride Batteries (Symposium I)

Organizing Committee: Y. Fukai, S. Ono, and S. Suda.

Reflecting Japan's status as a forerunner in the R&D and subsequent commercialization of metal-hydride batteries (which substitute for rechargeable Ni-Cd batteries), the majority of papers presented in this symposium were on application-oriented studies of metal hydrides for battery electrodes and other energy-related devices. Papers dealing with more basic properties were also presented. The small size of the symposium (13 papers for both oral and poster sessions) admittedly made it a somewhat minor assembly in this area of research, but facilitated communication among the participants with a wide spectrum of interests.



Prof. Frederick Seitz (The Rockefeller University) lectures during Symposium X.



Prof. Masao Doyama (Nishi Tokyo University) opens the ICAM'93 banquet. Doyama is president of MRS-J and vice president of IUMRS.

C_{60} and Related Materials (Symposium M)

Organizing Committee: E. Osawa, R. Fleming, K. Kitazawa, H.W. Kroto, C.N.R. Rao, and K. Tanabe.

Many active researchers in the fullerene field attended this symposium, including Profs. H. Kroto, C.N.R. Rao, and R.P.H. Chang, who gave plenary lectures. "Bucky tubes" received the most attention and the presentations on this

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Prof. R.P.H. Chang (Northwestern University), past president of IUMRS, presents Young Investigator awards at IUMRS-ICAM'93 to:

Vijay Gupta, Dartmouth College, Hanover, USA, "Recent Developments in Adhesion Measurements of Thin Films Interfaces" and other papers on the strength-structure-chemistry relationship for metal/ceramic interfaces (Symposia A, D, F, DD).

Fuhui Wang, Institute of Corrosion and Protection of Metals, Shenyang, China, "Oxidation Resistance of a Sputtered Microcrystalline Superalloy K38G Coating" (Symposium G).

Yoko Yamada, Tohoku University, Sendai Japan, "Strengthening of Metal Matrix Composites by Shape-Memory Effect" (Symposium H).

Chul Woo Nam, KAIST, Taejeon, Korea, "Preparation and Properties of Sol-Gel Derived Spin-on Glass Thin Films for Dielectric Planarization" (Symposium KK).

Hideki Kita, Isuzu Ceramics Research Institute, Kanagawa, Japan, "Reduction of Thermal Conductivity of Reaction-Bonded Si_3N_4 by Adding Mullite and Study of the Thermal Stress" (Symposium J).

Akinobu Sato (not in photo), NEC Corporation, Kawasaki, Japan, "Nanometer-Scale Reversible Recording with V_2O_5 Crystallized Glass Using Scanning Tunneling Microscopy (Symposium V).

subject were numerous. However, papers on the first report of the mass production of amorphous diamond by applying shock waves onto fullerenes, the beautiful STM photographs of dendritic crystals of epitaxially grown monolayers and bilayers of C_{60}, and the introduction of a variety of polar substituents on C_{60} by cyclo-addition reactions aroused much heated discussion as well. Also revealing was a theoretical prediction that the recently reported "metcar" cannot be a stable spherical cluster but a collection of smaller clusters. These interesting papers were presented mostly by relatively young researchers.

Ordered Polymers (Symposium Q)

Organizing Committee: T. Nishi, S. Ichihara, S.C. Kim, L. Monnerie, S. Nakahama, and L.A. Utracki.

To obtain polymeric materials with better properties or functions, further advanced control methods are needed for both molecular structure and higher order structure; and knowing whether the structure of each level is well-controlled or not requires further advanced methods of structural analysis. This point of view is important not only for specialty polymers, but also for general-purpose polymers. Symposium Q was organized to discuss the most recent advances on these subjects. In the oral session, 18 reports, including five invited reports, were presented. Both poster and oral sessions presented reports from many aspects of: the relationship between molecular structure and properties, molecular structure control by a catalyst, control of main chain orientation by structure control of the side chain, an approach for direct analysis of molecular structure, and control and analysis of multiphase structure of polymer alloys.

Biosensors (Symposium T)

Organizing Committee: I. Karube.

In this symposium, many presenters explained their work on biosensors using advanced devices (microelectrodes, ISFETs, highly sensitive microthermistors, surface acoustic wave devices, and piezoelectric devices, for example). The applications of biochemical analysis characterized by the devices, reagents, or chemical reactions (fluorescence polarization, chemiluminescence, chemical amplification, sensing using microorganisms, noninvasive detection for the human body, etc.) were reported. Also presented were a newly developed selective determination method of mRNA and biosensor using a novel marine bacterial enzyme.

Materials Synthesis and Modification by Ion Beams and/or Laser Beams (Symposium U)

Organizing Committee: I. Yamada, C.W. Allen, I.M. Buckley-Golder, H. Ishihara, E. Kamijo, T. Kawai, and C.W. White.

Symposium U was held as a joint symposium of IUMRS-ICAM'93 and the 2nd Ion Engineering Conference. Participants reported on advanced results of research, development of new materials for practical use, application of ion beams in materials research, and the large-scale projects on ion and laser processes. Review talks showing states and trends of research in special subject areas, and reports on new trends in technology were given by S.T. Picraux, T. Takagi, and T. Sato. Tendencies in future ion-beam research were considered in the talks by J.T. Cheung, J.H. Freeman, E. Rimini, J.S. Williams, and Z. Shichang. The following invited talks were given in thematic sessions: M. Hanabusa, K. Aoyagi, and J.J. Dubowski on laser processes; K. Gamo on ion beam nanofabrication; T. Hirao on application of ion implantation for manufacturing of electronic devices; and S. Yasunaga on ion and laser processing for industrial applications. M. Sosnowski reported on the use of gas cluster beams as a new method for sputtering and continuous low-energy and high-current implantation. Excellent results were presented on the production of thin films by ion beams, ionized cluster beams, and the development of new materials. The 122 talks given during this symposium included 43 from abroad and 79 from Japan. The organizers would like to express deep sympathy for the family of the late Prof. S. Furukawa who had been invited to talk.

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Fabrication of Silicon-Based Ceramics (Symposium W)

Organizing Committee: M. Mitomo, K. Komeya, R. Metselaar, and T.Y. Tien.

Symposium W covered such topics as powder preparation; phase relations; and microstructural characterization, grain-growth kinetics, microstructural development, and mechanical properties of silicon nitride, Sialon, and silicon carbide. The most significant and recent topic in this field is microstructural control during liquid-phase sintering of silicon-nitride-based ceramics. The target microstructure has bimodal distribution of grains, similar to that of whisker-reinforced ceramics. The advantage of the *in situ* composite or self-reinforced microstructure for the optimization of strength and fracture toughness was shown. The effect of phase transformation, nucleus addition, or sintering additive on microstructural development was discussed. The importance of the nucleus in microstructural control was shown. Other topics on monolithic and also composite materials were discussed in relation to the microstructures, which may provide a common basis for future work.

Construction and Functions of Organic Thin Films (Symposium EE)

Organizing Committee: T. Kajiyama, K. Fukuda, T. Kunitake, M. Lahav, P. Stroeve, and D.G. Whitten.

Symposium EE was composed of 22 oral presentations, including five invited talks and 24 posters. The invited papers provided up-to-date information on the structural analyses and control of Langmuir-Blodgett (LB) films based on various probe microscopes, the suprastructure and photochemistry of LB films, the crystal engineering of amphiphiles on the air-water interface, the gas transport characterization of complex LB films, and also the applications of monolayer, bilayer, and LB films to electrochemistry. The oral presentations were divided into three sessions: construction and characterization, interface and sorption, and functions of organic thin films. The oral presentations were related to frontier research fields on the molecular-order aggregation structural analyses based on total reflection x-ray and atomic force microscopy, surface force measurements, and electrical and optical properties. All the presentations stimulated substantial discussion. The poster presentations broadly covered topics in organic thin films, such as a novel concept of molecular assembly in a monolayer, manifestation of intrinsic functions for monolayer and LB films based on thermal molecular motion, surface modification by chemical adsorption, reasonable progress of nonlinear-optical properties of monolayer and LB films based on structural control, and applications of synthetic bilayer membranes for molecular templates.

Attendees at ICAM'93 (left to right): John Hopp (director, U.S. NSF Division of Materials Research), Mrs. Hopp, Frederick Seitz (The Rockefeller University), Mrs. Doyama, and Masao Doyama (ICAM co-organizer and president of MRS-J).

Intelligent Materials (Symposium FF)

Organizing Committee: K. Takahashi, M. Aizawa, G. Beck, S. Miyata, C.A. Rogers, and G. Wallace.

Presentations numbering about 40 included 15 expected lectures from abroad, but cancellations from France, China, and the former U.S.S.R. were announced. Invited lectures by Prof. M. Aizawa from the Tokyo Institute of Technology and by M. Vert from CNRS (France) were full of excitement. Aizawa spoke on biomaterials and Vert on intelligent functions of high polymers. There were many general lectures regarding the chemical field and a few lectures on inorganic substances, especially for electronics. The history of intelligent materials is short but has high expectations for the future.

Superconducting Materials (Symposium HH)

Organizing Committee: H. Koinuma, D.K. Finnemore, B. Raveau, K. Tagano, and M-K. Wu.

In Symposium HH, more than 100 contributed and invited papers were presented from 13 countries. In addition, J.G. Bednorz, 1987 Nobel laureate in physics, delivered the plenary lecture entitled "High T_c Superconductors: Any Chance for Non-Copper Oxides." The topics presented in the symposium can be classified into three main subjects: (1) new HTSC synthesis and characterization, (2) wire and tape, and (3) films and devices. Highlights include the synthesis, structure analysis, and carrier doping of new HTSC materials such as carbonate group (CO_3)-containing superconductors and infinite-layer cuprate superconductors. Also covered were the direct observation of vortex dynamics by electron beam holography in Nb and also Bi-Sr-Ca-Cu-O systems. Furthermore, research on the preparation of high-quality HTSC films with atomically smooth surfaces attracted much interest for future successful developments of Josephson tunnel junction devices.

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