APS Meeting Reflects Increased Materials Physics Coverage

From March 20-24, 1989, thousands of physicists converged on Saint Louis, Missouri for the annual "March meeting" of the American Physical Society. The March meeting has traditionally focused on condensed matter physics, and the majority of sessions were organized by APS's Division of Condensed Matter Physics. (Details of session topics and papers can be found in *Bull. Am. Phys. Soc.* **34**(3) (1989.) The role of the APS Materials Physics Topical Group, however, was noticeably greater at this meeting than in past years. Sixty-nine focused sessions, compared with 47 two years ago, were fielded (16 jointly with the Division of Condensed Matter Physics). Speakers in invited sessions increased by 50% over the same period.

The relative importance of the Materials Physics Topical Group to APS members, as gauged by current membership roles, is noteworthy. It has grown to be the largest (it was also the first) topical group, with a current membership of 2,628. This number, in fact, exceeds all but five divisions of APS. The exceptions, in order of increasing size are Nuclear; Plasma; Atomic, Molecular, and Optical; Particles and Fields; and Condensed Matter Physics Divisions.

The Committee on Applications in Physics offered an invited session mid-morning, March 21, on "Applications of High T_c Superconductors." The lead-off speaker, John Rowell of Bellcore (soon to be chief scientist for Conductus, Inc., Sunnyvale, California) put potential applications of the new materials in perspective. His premise was that, unlike the case of the laser which was invented before anyone knew how to apply it, all the breakthroughs needed to define desirable applications occurred long ago. High field, high critical current came in 1960 with Nb_3Sn, and 7-Tesla coils followed a year later...but Josephson junctions date back to 1963.

The recent critical temperature breakthroughs in superconductivity (>25 K in 1986, >77 K in 1987, >120 K in 1988) did not, according to Rowell, change what we already know of the basic requirements imposed on any superconductor by applications, i.e., they show high T_c and high J_c in the presence of a magnetic field, are chemically stable, and are compatible with normal shunting materials such as copper. Requirements specific to thin-film electronic applications were listed as displaying high T_c on a low-temperature substrate with which there is no reaction, being patternable, maintaining good superconductivity to within a coherence length of the surface, and surviving thermal cycling. He noted in summary that the entire problem today is mastery of the new materials, which present significant preparation problems and surface and grain boundary problems.

John Rowell explains his views on applications of high T_c superconductors.

William F. Brinkman describes the state-of-the-art in lightwave communications at the Materials Physics Topical Group's symposium on "Research Opportunities in Materials Physics: Perspectives from Industry."

On the evening of March 21, the Materials Physics Topical Group ran an invited symposium on "Research Opportunities in Materials Physics: Perspectives from Industry." Speakers covered aerospace (A. Bement, TRW), electronics—primarily computers (D. Eastman, IBM), communications—primarily lightwave (W. Brinkman, AT&T Bell Laboratories), energy (L. Ianniello, DOE), and automotive (J. McTague, Ford) perspectives.

Overall, the impression given was that advances to date based on improved materials have been impressive and that still greater challenges remain for further materials development. The general target of finding "stronger, stiffer, hotter and lighter" materials for civil and defense aerospace applications remains and crosses the metals-ceramics-polymers-composites boundaries. Space power systems particularly need materials advances. From a modeling viewpoint, the gap between the microscopic quantum and macroscopic classical levels, i.e., the "meso"-scale region, needs to be bridged.

In electronic computing, the phenomenal trend in circuit density and advanced architectures brought predictions of "mainframe computing power in workstations" over the next one or two decades, and of implementing "parallelism" to further increase capability. A significant challenge is the development of characterization tools up to the task of testing circuits as on-chip densities increase. Advances of similar orders of magnitude apply to lightwave communications, where today 3-4 gigabits/s can be transmitted along a single optical fiber compared with only 45 megabits/s in 1981. The optical loss problem has essential been solved by reaching the theoretical limit for pure glass but overcoming dispersion remains an issue. The route to achieving terabits/s (one terabit/s would allow multiplexing 50,000 picturephone conversations on a single fiber) may involve wavelength division multiplexing and would require broad-band optical (rather than electronic) amplifiers for signal regeneration.

The energy industry faces significant problems related to all current energy production alternatives. Hydroelectric and geothermal routes are limited in scope; solar dependability (weather and diurnal cycles) is suspect; gas and oil supplies are

https://doi.org/10.1557/S0883769400062977 Published online by Cambridge University Press

decreasing and all fossil fuel use (including coal) releases CO_2 into the atmosphere; and, finally, the nuclear alternative suffers from safety questions and severe waste disposal requirements. Many materials-related studies are relevant to these dilemmas, including surface physics (catalysis), uniform and tough ceramics development, radiation embrittlement prediction and prevention, superconductors for transmission and storage, and photovoltaic devices. A case in point with respect to embrittlement is the current unexpected observation of "premature" embrittlement effects found in the High Flux Isotope Reactor at Oak Ridge National Laboratory, where it is now thought that the thermal neutron flux was not adequately accounted for in projecting component lifetimes.

Prizes and Awards

Among the prizes and awards presented by APS in Saint Louis was the International Prize for New Materials which went this year to K.C. Kao (Chinese University of Hong Kong), R.D. Maurer (Corning Glass Works), and J.B. MacChesney (AT&T Bell Laboratories), for their contributions to the R&D which led to practical low-loss optical fibers. At the same ceremonial session, the 1989 David Adler Lectureship Award was conferred on Robert W. Balluffi (Massachusetts Institute of Technology) for his work on sintering mechanisms, Kirkendall phenomena, dislocation climb, solid-state diffusion, grain-boundary structure and energetics, and radiation damage, to name a few. Balluffi was an MRS Councillor from 1986 through 1988.

Robert Balluffi (right) receives the David Adler Lectureship Award from APS president J. Krumhansl.

John Silcox of Cornell University is appointed new chairman of the APS Materials Physics Topical Group.

Silcox Named Chair of Materials Physics Topical Group

The chairmanship of the Materials Physics Topical Group, which changes each March, was assumed for the next 12 months by John Silcox, David E. Burr Professor of Engineering at Cornell University, who succeeds Bill Appleton of Oak Ridge National Laboratory. Silcox is an electron microscopist primarily interested in electron energy loss spectroscopy as applied to materials in the context of analytical electron microscopy. He has served on the Solid State Sciences Committee of the National Research Council and presently serves on the Materials Research Advisory Committee at the National Science oundation. He is a former president of the Electron Microscopy Society of America. On assuming the chairmanship, Silcox said that, "the rapid growth of the MPTG to a substantial membership and program reflects the need for this activity within the APS." He sees "the topical group serving an important bridging role at the APS March meeting between condensed matter physics and the broad materials community."

E.N. Kaufmann

International Conference Focuses on Defects in Insulating Crystals

The International Conference on Defects in Insulating Crystals (ICDIC '88) was held in Parma from August 29 to September 2, 1988.

The conference continued the traditions of this series of international conferences, which originated as a meeting on "Color Centers in Alkali Halides" in 1956. Over the years that meeting has developed into the International Conference on Defects in Insulating Crystals.

ICDIC'88 focused on the current state of knowledge of defects and defect processes in a wide range of materials. It brought together scientists from both academic institutions and industry and offered a unique opportunity to discuss the role of defects in modern material technology. The Conference stressed the value of a fundamental scientific understanding of defects in the design and application of materials for specific purposes, even of technological relevance.

Organized and chaired by Prof. Rosanna Cappelletti of the Physics Department of the University of Parma, the Conference drew 266 participants from 32 countries.

The scientific program was planned and selected by an international program committee. It included plenary sessions, two parallel sessions (Session A mainly devoted to the Electronic Properties of Defects, and Session B mainly devoted to the Ionic Transport Properties), and two poster sessions. Less than one third of the abstracts involved alkali halides, while the remainder treated a wide variety of insulating solids.

Twenty-two invited speakers covered a wide range of topics, including:

Energy- and photo-transfer among defects, superfluorescence, dynamical processes associated with self-trapped excitons in insulators;

Application of modern techniques such as magnetic spectroscopies, synchrotron radiation, quasi-elastic neutron scattering, computer simulation for studying defects;

Transport processes along grain boundaries and in dispersed ionic conductors;

Defect applications, such as x-ray storage phosphors, ion implantation in electro-optic materials, photographic process;

Gas sensing and fusion materials, and color center lasers; and the

Role of defects on materials of technological interest, such as fluoride glasses and perovskite systems, which exhibit high temperature superconductivity.

Contributed papers presented orally in the parallel sessions numbered 67; poster presentations were about 200. The two-page abstracts of the invited and contributed papers were collected in a 680-page book which was distributed to all the participants at the beginning of the Conference.

Complete manuscripts of the invited papers will be published in a special issue of *Crystal Lattice Defects and Amorphous Materials* by Gordon and Breach.

L. Zanotti

https://doi.org/10.1557/S0883769400062977 Published online by Cambridge University Press