and on the bottom of the Si wafer. Afterwards, Au wire leads were attached to both Al layers with Ag paint.

The current-voltage characteristics of over 100 diodes were measured. The EL of the devices was found to arise from the Si only. The efficiency of the EL varied between 10^{-6} and 10^{-4} at an injection current of 50 mA. These efficiency values are several orders of magnitude higher than those previously observed for MOS diodes. The rise and fall times of the diodes varied from 4.5 μs to 20 μs, and 1.5 μs to 15 μs, respectively. Longer rise times were found to correspond to longer fall times and improved EL efficiencies. The researchers attributed the variations in the measured parameters to variations in the nonradiative recombination process in the devices. In devices with fewer nonradiative recombination, the rise and fall times are longer, and the fraction of recombination due to the radiative recombination process is larger. The researchers speculate that the variation in the radiative recombination state densities arise from variations in silicon quality across the wafer, with the recombination being most efficient for high-quality spots.

The devices with larger rise and fall times also exhibited near-lasing-threshold behavior—a rapid output power increase at a threshold value of the input current. Threshold behavior was accompanied by the appearance of resonance modes in the EL spectrum. The researchers attribute the near-lasing behavior to the improved luminescence efficiency coupled to the low-absorption cross section of the Si and the formation of a quasi-cavity by two reflective metal layers in the device.

GREG KHITROV

News of MRS Members/Materials Researchers

Robert Langer Receives the 2002 Charles Stark Draper Prize

Robert Langer, Kenneth J. Germeshausen Professor of Chemical and Biomedical Engineering at the Massachusetts Institute of Technology, has been awarded the Charles Stark Draper Prize for his invention of medical technologies that help prolong lives and ease suffering. Credited with developing biocompatible polymer technologies that control the release of medicine over time—from weeks to years—Langer's contributions have significantly advanced the controlled drug-delivery industry.

His engineering of polymer plastics is now allowing delivery of medicine in unique ways to difficult locations in the body. One of his biodegradable polymer inventions to treat brain cancer was the first such chemotherapy that could be delivered directly to a tumor site.

Considered to be both a prolific innovator and researcher, Langer's patents have been licensed or sublicensed to over 80 pharmaceutical, chemical, biotechnology, and medical-device companies; a number of companies were launched on the basis of these patent licenses. He nurtures his students into taking their thesis work to the marketplace, therefore making him an example of the role academic research engineers can play in bridging academia and industry.

Langer has written 700 articles. He has also written 400 patents, one of which was cited as the outstanding patent in Massachusetts in 1988 and one of the 20 outstanding patents in the United States.

Langer has received more than 80 major awards, including the Gairdner Foundation International Award in 1996, and the Lemelson–MIT Prize in 1998. In 1989, Langer was elected to the Institute of Medicine, and in 1992 he was elected to both the National Academy of Engineering and the National Academy of Sciences.

He has served, at various times, on eight boards of directors and 20 scientific advisory boards for such companies as Alkermes, Mitsubishi Pharmaceuticals, Warner-Lambert, and Guilford Pharmaceuticals.

Langer received his bachelor's degree from Cornell University in 1970 and his doctorate from MIT in 1974, both in chemical engineering. He has received honorary doctorates from the Swiss Federal Institute of Technology Zurich (ETH Zurich); the Technion-Israel Institute of Technology; and the Université Catholique de Louvain, Belgium. He is chair of the U.S. Food and Drug Administration's Science Board, the administration's highest advisory board.

The Draper Prize is awarded annually and consists of $500,000 and a gold medallion. The prize was established by the National Academy of Engineering (NAE) with an $8 million endowment from the Charles Stark Draper Laboratory, to honor the "father of inertial navigation." It is awarded for innovative engineering achievement or a body of work extending over a period of years. The work must demonstrate a proven innovation that contributes to human welfare and freedom. NAE is an independent, nonprofit institution.

Andrzej Deptula and **Wiestawa Lada** (Institute of Nuclear Chemistry and Technology, Warsaw) received two awards from the INNOVATION 2001 International Exhibition of Inventions held on October 17–19, 2001, in Gdansk, Poland: **First Award and the Cup of the Rector Navy Academy** for "Method for Preparation of High-Temperature Superconductors," invented with T. Olczak, M.T. Lanagan, S.E. Dorris, K.C. Goretta, and R.B. Peoppel; and **First Award and Gold Medal** for "Method for Preparing of Calcium Phosphates Layers, Especially Hydroxyapatite," invented with R.Z. LeGeros, T. Olczak, and J.P. LeGeros.

Brij M. Moudgil of the University of Florida has been selected to receive the institution's Research Foundation Professorship award in recognition of his distinguished record of research and scholarship.

Rustum Roy of The Pennsylvania State University has been honored by the Ministry of Education, Culture, Sports, and Technology of Japan for exceptionally meritorious service to science in Japan, in a ceremony at the ministry presided over by Minister Atsuko Toyama on March 19, 2002. This award recognizes the contributions that Roy has made over a 35-year period to science and technology in Japan.

S.K. Sundaram of Pacific Northwest National Laboratory (PNNL) has been honored as an "Outstanding Mentor" under the Office of Science, Fellowship Programs, of the Department of Energy. He has also received the PNNL Director's 2002 Fitzner-Eberhardt award for outstanding contributions to science and engineering education.

https://doi.org/10.1557/mrs2002.139 Published online by Cambridge University Press

The **American Physical Society** (APS) announced 2002 awards and honors:

Chris G. Van de Walle (Xerox) received the **David Adler Lectureship Award** for his incisive theoretical contributions to the understanding of the behavior of hydrogen in semiconductors and heterostructure energy-band diagrams and the exceptional exposition of this work in the scientific community;

Alan Garscadden (Air Force Research Laboratory) received the **Will Allis Prize** in recognition of his distinguished career in gaseous electronics, marked by sustained creativity in linking fundamental processes to the macroscopic properties of gas discharges and plasmas, and for his dedicated role as an advocate for the field of gaseous electronics;

Timothy J. Bunning (Air Force Research Laboratory) received the **John H. Dillon Medal** for his outstanding accomplishments in developing polymer-based materials for optical applications and for elucidating the physics and chemistry underlying their formation;

Tom Witten (University of Chicago) received the **Polymer Prize** for outstanding theoretical contributions to the understanding of polymers and complex fluids;

James Allen (University of Michigan) and **Thomas Timusk** (McMaster University, Canada) received the **Frank Isakson Prize** for their outstanding contributions to the field of spectroscopy in strongly correlated electron systems leading to the elucidation of many-body physics;

Sumio Iijima (NEC) and **Donald S. Bethune** (IBM) received the **James C. McGroddy Prize** for the discovery and development of single-walled carbon nanotubes, which can behave like metals or semiconductors, conduct electricity better than copper, and transmit heat better than diamond, and which rank among the strongest materials known; and

Allan Bromley (Yale University) received the **Nicholson Medal** for his roles as a research scientist, an outstanding teacher, a supportive mentor and colleague, a leader of the physics community in this country [United States] and worldwide, and advisor to governments.

The **Minerals, Metals & Materials Society** (TMS) announced the following 2002 awards:

Michael F.X. Gigliotti (General Electric Corporate Research & Development) received the **Application to Practice Award** for contributions to superalloy eutectics and airfoil casting, the development of Ti-Al alloys, and the processing of Ti alloys to increase inspectability while minimizing the occurrence of Ti-N inclusions;

John M. Poate (Axcelis Technologies, Beverly, Mass.) received the **John Bardeen Award** for the development of ion-beam techniques for the analysis and modification of new surface properties of several classes of electronic materials;

Michel Rappaz (Ecole Polytechnique Fédérale de Lausanne) received the **Bruce Chalmers Award** for his outstanding contributions to the numerical modeling of microstructures coupled with macroscopic models of heat and mass transport in modern solidification processing;

Paul V. Braun (University of Illinois) received the **Robert Lansing Hardy Award** in recognition of outstanding promise for a successful career in the broad field of metallurgy by a metallurgist under the age of 30;

Larry Kaufman (Massachusetts Institute of Technology) received the **William Hume-Rothery Award** in recognition of outstanding scholarly contributions to the science of alloys;

Frans Spaepen (Harvard University) received the **Institute of Metals Lecturer & Robert Franklin Mehl Award** in recognition of his outstanding scientific leadership; and

Robert L. Snyder (The Ohio State University) received the **Leadership Award** for his energetic leadership in materials science and engineering education and in materials characterization by automated x-ray powder diffraction analysis.

Man H. Yoo (Oak Ridge National Laboratory) and **Chong Fu** (Oak Ridge National Laboratory) received the **Champion H. Mathewson Award** for their article "Physical Constants, Deformation Twinning, and Microcracking in Titanium Aluminides."

The following have been named **fellows of TMS**:

Gary R. Purdy (McMaster University, Canada) for contributions to the understanding of diffusion and phase transformations in materials;

Ricardo B. Schwarz (Los Alamos National Laboratory) for outstanding contributions to the scientific understanding of amorphous metals, the thermodynamics and kinetics of alloy phases, dislocation dynamics, mechanical alloying, and ultrasonics;

Changxu Shi (National Natural Science Foundation of China) for his significant research contribution in nickel-based superalloys and alloy steels and his leadership in the materials community;

Man H. Yoo (Oak Ridge National Laboratory) for his elucidation of the mechanical properties of hexagonal metals, high-temperature alloys, and ordered intermetallics, through atomistic and continuum-scale modeling of plastic deformation and fracture; and

Edgar A. Starke Jr. (University of Virginia) for seminal and sustained contributions to the metallurgy of light structural alloys, mechanisms of fatigue and fracture, and leadership in engineering science education.

NACE International announced the following 2002 awards during its 57th annual conference, CORROSION/2002, on April 7 in Denver, Colo.:

Robert S. Charlton (Levelton Engineering Ltd., Canada) received the **R.A. Brannon Award** for contributions at the association level to advance the understanding of corrosion and its prevention through diligent and unique service in the promotion and development of NACE International;

Rik-Wouter Bosch (SCK-CEN Nuclear Research Center, Belgium) received the **A.B. Campbell Award** for the most outstanding paper published in *Corrosion Journal* or *Materials Performance* in the current year, for his article "Electrochemical Frequency Modulation: A New Electrochemical Technique for Online Corrosion Monitoring," which appeared in the January 2001 issue of *Corrosion Journal*;

Robert Baboian (RB Corrosion Service, Greenville, R.I.) received the **T.J. Hull Award** for the development of information on the understanding of corrosion processes and the prevention of corrosion damage, and for making this information accessible and available to both engineers and scientists concerned with corrosion;

Gerald M. Gordon (Framatome, Las Vegas) received the **F.N. Speller Award** for his distinguished and sustained contributions to the understanding of corrosion and stress-corrosion cracking (SCC) in light-water reactors, as well as the physical metallurgy of austenitic stainless steel and nickel-based alloys and the effects of radiation and water chemistry on SCC;

Rudolph Buchheit (The Ohio State University) received the **H.H. Uhlig Award** in recognition of his enthusiastic teaching of corrosion at all levels, his involvement of undergraduate and high school students in research activities, and his continued promotion of the highest quality of corrosion research and education; and

Koji Hashimoto (Tohoku Institute of Technology, Japan) received the **Willis Rodney Whitney Award** in recognition of his public contributions to the science of corrosion.

https://doi.org/10.1557/mrs2002.139 Published online by Cambridge University Press

The following received the **Technical Achievement Award**:

John E. (Jack) Bennett (J.E. Bennett Consultants Inc., Chardon, Ohio) for his development of a number of anode systems for the cathodic protection of reinforced concrete—his research and other contributions have led to new techniques and improved standards in the field;

Richard J. Horvath (Shell Global Solutions U.S.) for outstanding technical leadership and development work in corrosion engineering, especially in areas most relevant to the petroleum refining industry;

Robert M. Kain (private consultant) for his outstanding technical contributions to the area of localized corrosion in marine and saline environments, particularly crevice corrosion of stainless steels and nickel-based alloys, and for his leadership in developing corrosion test standards;

Ralph W. (Bud) Ross (CorMat, Inc., Huntington, W.V.) for his contributions to corrosion engineering, especially in the application of nickel alloys; and

Kunigahalli L. (Ken) Vasanth (Naval Surface Warfare Center, Carderock Division, West Bethesda, Md.) for his outstanding service to the U.S. Navy by providing solutions to fleet corrosion issues, specifically through the use of vapor-phase corrosion inhibitors and other control technologies.

The following have been named **fellows of NACE International: Arne Dugstad** (Institute for Energy Technology, Norway), **Edward L. Hibner** (Special Metals Corp., Huntington, W.V.), **John N. Murray** (Murray's et al., Timonium, Md.), **John R. Scully** (University of Virginia), and **William H. (Bud) Seager** (Corrpro Canada, Inc.).

The **National Academy of Engineering** has elected 74 members and seven foreign associates. Among the members are

Rakesh Agrawal (Air Products and Chemicals Inc., Allentown, Pa.) for contributions to the development and worldwide implementation of high-efficiency and high-purity cryogenic and noncryogenic gas-separation processes;

William F. Banholzer (Global Technology and GE Plastics, Pittsfield, Mass.) for breakthroughs in stealth materials and contributions to the isotope effect in solid-state physics, and for business leadership;

Frank S. Bates (University of Minnesota, Minneapolis) for important contributions on the phase behavior of polymer blends, particularly block co-polymers;

C. Jeffrey Brinker (Sandia National Laboratories) for outstanding contributions to the science of sol-gel processing, and for the invention of porous materials with controlled structure;

Joe C. Campbell (University of Texas at Austin) for contributions to the development of high-speed, low-noise avalanche photodiodes;

Morris Chang (Taiwan Semiconductor Manufacturing Co., Taipei) for contributions to the integrated-circuit industry, the creation of the pure-foundry business model, and the enabling of the fabless semiconductor industry;

Douglas M. Chapin (MPR Associates Inc., Alexandria, Va.) for improvements in reliability and the prevention and mitigation of core damage accidents in nuclear reactors worldwide;

Andrew R. Chraplyvy (Bell Laboratories, Lucent Technologies, Holmdel, N.J.) for contributions to the development of high-capacity optical-fiber communications systems;

John H. Crawford (Intel Corp., Santa Clara, Calif.) for the architectural design of widely used microprocessors;

Bonnie J. Dunbar (NASA Johnson Space Center, Houston) for personal leadership and significant contributions to solutions to engineering-design problems in human space flight and on-orbit operations;

Robert E. Fontana Jr. (IBM Almaden Research Center, San Jose, Calif.) for contributions to microfabrication techniques for the manufacture of thin-film storage devices;

Alan J. Heeger (University of California, Santa Barbara) for co-founding the field of conducting polymers and for pioneering work in making these novel materials available for technological applications;

Evelyn L. Hu (University of California, Santa Barbara) for contributions to the processing of semiconductor structures and devices;

Klavs F. Jensen (Massachusetts Institute of Technology) for fundamental contributions to multiscale chemical-reaction engineering with important applications in microelectronic materials processing and microreactor technology;

Alan G. MacDiarmid (University of Pennsylvania, Philadelphia) for the co-discovery and development of conductive polymers;

Bernard S. Meyerson (IBM Thomas J. Watson Research Center, Yorktown Heights, N.Y.) for the development of low-temperature epitaxy of SiGe for the fabrication of heterojunction bipolar integrated circuits for telecommunications;

Brij M. Moudgil (University of Florida, Gainesville) for advances in mineral processing through innovations in selective polymer and surfactant coatings, and for professional leadership;

Gérard A. Mourou (University of Michigan, Ann Arbor) for the introduction of the chirped pulse amplification technique, enabling high-intensity lasers;

Cherry A. Murray (Bell Laboratories, Lucent Technologies, Murray Hill, N.J.) for seminal work on order-disorder transitions in colloidal systems, and for leadership in bringing new concepts from research to production;

Gordon C. Osbourn (Sandia National Laboratories) for originating the field of strained-layer superlattices and related structures, which has led to revolutionary advances in electronics and optoelectronics;

Neil E. Paton (Howmet Corp., Whitehall, Mich.) for contributions to the development of advanced aluminum and high-temperature alloys for aerospace applications;

Buddy D. Ratner (University of Washington, Seattle) for contributions to the understanding of the surface interactions of biological molecules and cells with medical implants; and

Subra Suresh (Massachusetts Institute of Technology) for the development of mechanical-behavior theory and experiment for advanced materials and applications, and for demonstrating fruitful new avenues for structural study. Among the foreign associates are

Hiroyuki Abe (Tohoku University, Japan) for outstanding contributions in the extraction of geothermal energy and leadership in the development of nondestructive evaluation and electronic-packaging techniques; and

J. David Embury (McMaster University, Canada) for outstanding contributions to fundamental structure/mechanical property relations of materials and their applications.

The **National Academy of Sciences** has elected 72 members and 15 foreign associates, including members

Zdeněk P. Bažant (Northwestern University), **John L. Hennessy** (Stanford University), **Alan G. MacDiarmid** (University of Pennsylvania), **Mark A. Ratner** (Northwestern University), and **Lawrence H. Summers** (Harvard University); and foreign associates **Gerhard Ertl** (Max Planck Society for the Advancement of Science, Berlin), **Wolfgang Ketterle** (University of Heidelberg and Massachusetts Institute of Technology), and **Ho Wang Lee** (National Academy of Sciences of the Republic of Korea). □

https://doi.org/10.1557/mrs2002.139 Published online by Cambridge University Press