

IBM Research Scientists Win National Medal of Technology

Three scientists who, as members of IBM's Thomas J. Watson Research Center in the 1970s, discovered the magneto-optic (MO) materials that made possible the modern rewritable optical disk storage industry have earned National Medals of Technology. Praveen Chaudhari, who still works at Watson, and Jerome J. Cuomo and Richard J. Gambino, both retired from IBM, received their medals from President Bill Clinton in a ceremony at the White House on October 18. Congress established the National Medal of Technology in 1985. Any U.S. citizen, team or U.S.-owned company is eligible for the annual award.

Working together at Watson in the 1970s, the IBM trio discovered a combination of elements with unusual magnetic and optical properties that made them suitable for optical data storage. Magneto-optic materials are so named because magnetic fields can alter the way in which light passes through them. When heated with a brief pulse of focused laser light in the presence of an external magnetic field, they form cylindrical domains with a magnetic orientation that is the same as that of the external field.

The materials discovered by Chaudhari and his colleagues consist of combinations of two types of elements — so-called rare earth elements and transition metals — that form amorphous, rather than crystalline,

alloys. The amorphous structure permits the formation of very small, well-defined domains in the materials that can still yield strong, low-noise MO signals. Various members of the IBM-invented family of materials offer other advantageous properties. They require modest magnetic fields and low laser power for erasing and writing, and are sensitive to a broad range of laser wavelengths. In 1993, IBM demonstrated a world-record optical data storage density of 2.5 billion bits per square inch on a removable disk that used a blue laser and an amorphous MO consisting of terbium, iron and cobalt.

Since the 1980s, films of these materials — just one-millionth of an inch thick — have been used to hold data on rewritable magneto-optic disks. The disks are used by large organizations to store, retrieve and update vast amounts of information on economical and easily portable cartridges. By contrast, data on read-only CD-ROMs cannot be updated. Virtually all of today's rewritable optical disks worldwide still use these IBM-invented materials.

"We are proud that our scientists have been honored with the nation's highest technology award," said Jim McGroddy, IBM's senior vice president, research. "Their invention has

spawned a worldwide \$2 billion market that is having a major impact on American business and economy. IBM will continue to be the foundry for much of the intellectual capital created in our industry. Our first imperative is to leverage technology in the marketplace."

Chaudhari, who has a doctoral degree from the Massachusetts Institute of Technology and joined IBM in 1966, remains a key figure in some of the company's most advanced science and technology developments. He has served on national and presidential advisory councils. He is a member of the National Academy of Engineering, a fellow of the American Physical Society and vice president of the Council for the International Union of Pure and Applied Physics.

With degrees from Manhattan College, St. John's University and Denmark's Odense University, Cuomo received many awards for his inventions during a 30-year career at IBM. Elected a member of the National Academy of Engineering in 1993, he has served on the National Research Council Committee. He is now a chaired professor in the Materials Science and Engineering De-

partment at North Carolina State University.

Gambino, who has a master's degree from the Polytechnic Institute of New York, has also won many awards for his research. He is now a professor in the Materials Science and Engineering Department at the State University of New York at Stony Brook.

With this year's award, IBM scientists have now won the National Medal of Technology more often than those of any other company. Previous company recipients are:

- N. Joseph Woodland, for barcode technology and contributions to the Universal Product Code, in 1992.
- John Cocke, for reduced instruction set computer (RISC) architecture, in 1991.
- Robert H. Dennard, for the one-device memory cell, the basis for industry-standard dynamic random-access memory (DRAM), in 1988.
- Reynold B. Johnson, for the 305 RAMAC, the first magnetic hard-disk system designed for data storage, in 1986.
- Frederick P. Brooks, Erich Bloch and Bob O. Evans, for the System/360 mainframe computer, in 1985. ■



Praveen Chaudhari, Jerome J. Cuomo and Richard J. Gambino with the optical disks made possible by their discovery.

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