

APRIL 2, 1990

# Bell Labs News

A Bell Labs chip-processing material is picked to become industry standard because it's

## Ir-Resist-able

BY HOLLY BIGELOW MARTIN

A new photolithographic resist being developed at Murray Hill has been chosen by Sematech, a consortium of 14 U.S. semiconductor manufacturers, to aid in its fight to revive this country's troubled semiconductor industry. AT&T signed an agreement with Sematech this past December to improve the process for using the resist to make faster, more powerful integrated circuits. AT&T signed a separate agreement giving Olin Corporation the right to manufacture the resist, a light-sensitive chemical compound, for sale to Sematech Companies.

The resist can be used to produce highly complex chips with features as small as 0.3 micrometers, or roughly 1/400th the diameter of a human hair. "These kinds of features would let us make processors with many times the power of today's best systems," said Larry Thompson, head of the Lithographic and Chemical Engineering Materials Research Department.

The new resist makes use of "deep ultraviolet" radiation in the wavelength range of 200 to 300 nanometers. Resists used today operate in the ultraviolet range of 300 to 400 nanometers and are limited to making chips with feature sizes of about 0.6 micrometers.

Photolithographic resists are sensitive to light. To create an integrated circuit, a thin film of resist is coated onto the surface of a semiconductor wafer. By using a mask, selected areas of the resist film are exposed to light, which causes a chemical reaction to occur on the film. This chemical reaction results in a change in solubility and a pattern may be created by dissolving away either the exposed areas, in the case of a positive resist, or the unexposed regions, in the case of a negative resist. "Overall, the process is quite similar to developing a photograph," Thompson said.

After the development process, the surface of the wafer can be etched out or built up in the resist-free areas. By repeating this procedure a number of times, a semiconductor device containing three-dimensional electronic circuits can be built.

By using deep-ultraviolet (deep-UV) light the new resist can help build much more complex and powerful integrated circuits than can be made with today's photoresists. That's because the limiting feature size depends on the wavelength of the light used. With the smaller-wavelength deep-UV light, the patterns can be made much smaller and closer together, giving the chip designer more room to compress more features onto the chip.



Om Nalamasu, left, Ray Cirelli and May Cheng, of the Lithographic Systems Development Department, inspect wafers made with their new process.

"There are two things you need in a deep-UV resist," said Thompson. "First, it must be sensitive to deep-UV light, and second, it has to be partially transparent, so that the light can penetrate the film. Getting both of these properties in a single

material is difficult."

"We're using a polymer that is totally insoluble in water-based developer," explained Elsa Reichmanis, a supervisor in Thompson's department. "To that we add a chemical

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## Kissane Replaces Diczok

On March 15, John Kissane became general attorney, General Law Division, transferring from his previous position as general attorney, AT&T Communications Products Group.

Kissane began his career with AT&T in 1972 as a patent attorney for Western Electric. In 1979, he became an attorney at the General Law Division at AT&T corporate and in 1983 he was promoted to General Attorney for AT&T Information Systems. Under a recent business realignment, Kissane pro-

vided legal support to the Communications and Computer Products Sourcing and Manufacturing Division.

In his new position, Kissane will provide intellectual-property-related legal services at Bell Laboratories.

Kissane replaces Paul Diczok, who recently accepted the position of General Attorney in the AT&T Communications Products and Data Systems Groups. ■



Kissane

## BULLETIN BOARD

**1990 AT&T Design for "X" (DFX) Conference, May 16-17, Greensboro, N.C.**

AT&T employees are invited to attend the annual conference on DFX: design for manufacturability, testability, reliability, serviceability, safety, and other "downstream" considerations.

There will be over 70 AT&T presentations during the first two days as well as guest speakers from Apple Computer, Sony America, and the U.S. Navy. A half-day of factory tours is scheduled for May 18.

Deadline for registration is April 20. Contact Dick Steinbrenner at att/bonnie/rtb or (201) 386-7053 for details on the program and registration.

**AT&T Computer Systems Affiliate Customer Symposium, April 17, Holmdel.**

AT&T employees are invited to attend an AT&T Computer Systems symposium, which will feature speakers in the main auditorium (8:45 a.m. to Noon) and product demonstrations in the atrium (Noon until 3:00 p.m.).

Rich McGinn, president, AT&T Computer Systems, will discuss his business unit's strategy. Other talks will cover client server strategy, high-performance and fault-tolerant products, and Intel products.

Product presentations include a high-resolution graphics workstation, System 7000 and other software and hardware products.

partment. "It's hard to separate the two parts, because you can't fully develop a process without a material. It's a cooperative project, requiring a constant interaction between all the different groups involved."

Under the agreement with Sematech, a viable process will be demonstrated so that Olin can start manufacturing in limited quantities for the member companies by the first half of next year. After one year of exclusive use by these companies, Olin will be free to sell the photoresist to other manufacturers.

"As I see it, there are two or three advantages to having an outside customer like Sematech," said Pol. "First, the process development money they provide offsets some of our expenses. Second, the schedule and tough requirements will help us be more productive. But most important is the fact that, in giving us this contract, they have shown that they view this material as a promising one. It's a vote of confidence for our approach."

"This is the first time a new commercial resist chemistry will be used in the IC industry in 25 years," Thompson said. "Because AT&T does not sell lithographic materials, we had to find an external company to partner with. We're happy to be collaborating with Olin."

"The Bell Labs material is a positive-acting deep-UV resist, in contrast to several commercially available negative resists," said Reichmanis. "Advantages to having a positive-acting material, like the one we're developing here, include better resolution and better process control."

Positive resists are used in production today. "In many ways the two complement each other," added Pol. "I think the industry would like to have both available, but given the choice, they might continue with a positive resist, because they could keep the same masks."

Deep-UV resists are likely to be the next-generation technology. "The deep-UV resist is the future in semiconductor manufacturing, and will produce semiconductors that compete in the global market in terms of performance and price," said Robert Noyce, president and chief executive officer of Sematech. "AT&T and Olin are making valuable contributions toward our efforts to make America the undisputed leader in semiconductor manufacturing." ■

## NEWSMAKERS



Ackenhusen

**John Ackenhusen**, head of the Signal Processor Systems Engineering Department at Whippany, has been elected president of the IEEE Signal Processing Society. He will serve a two-year term.



Gottscho

**Richard Gottscho**, head of the Electronics Materials Research Department at Murray Hill, has been appointed a member of the Plasma Science Committee of the National Research Council Board of Physics and Astronomy. The committee provides guidance on ways to maintain and strengthen plasma science as a discipline.



Lee

**Rodney Lee**, MTS in the Multiplex Circuits and Project Management Department at Ward Hill, was recently honored as a Black Achiever by the Greater Boston YMCA. He was among 117 individuals to be recognized for their encouragement of minority and disadvantaged youth. Black Achievers serve as role models and mentors to youth who aspire to high academic and professional achievement.



Zave

**Pamela Zave**, DMTS in the Digital Systems Research Department at Murray Hill, has won the Best Paper of 1989 Award from IEEE Software. Her paper, "A Compositional Approach to Multiparadigm Programming," explores how programs written in different languages can communicate, and how the resulting multiparadigm program can be validated.



**Dave Nixon**, of the Lithographic Materials and Chemical Engineering Research Department, did the polymer scale-up for the new resist.

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that forms an acid when exposed to deep-UV light. After exposing the film through a patterned mask, we heat it. During that thermal process, the polymer in the exposed areas undergoes a reaction with the acid that makes it soluble in alkaline water, so that part of the resist dissolves in the developer solution, leaving a three-dimensional relief image." The parts of the film that were not exposed remain in place during development.

Synthesis of the new resist material is an ongoing collaborative effort between Reichmanis, Janet Kometani and Mike Bohrer in the Lithographic Materials and Chemical Engineering Department, and Frank Houlihan and Thomas Neenan in Don Loan's Plastics Chemistry Research and Engineering Department. The researchers have been working closely with Om Nalamasu in Jim Clemens' Lithographic Systems Development Department to develop a commercial process for using the resist.

"The problem has two facets which are highly interactive: one is coming up with a material that works and the other is developing a process that will work under manufacturing conditions," said Victor Pol, a supervisor in Clemens' de-

## Faster Starts on New Jobs

The Kelly Education Center is now offering a career development workshop that can significantly reduce the time, cost and pain it might take to come up to speed on a new job. The workshop, called Fast Start, was designed by Blessing/White, the training consultants who created Managing Professional Growth, and is intended for anyone new to a job—college recruits, market hires, reassigned or redeployed personnel,

or groups whose structure or mission has changed.

Fast Start provides people and their management with a structured opportunity to discuss not only the "whats" of a new job (the deliverables), but the "hows" as well—the strategies, tactics and methods of a job.

For information contact Janet Sloan at the Kelly Center (201) 957-6432 or mtfmi/janet.

## OSA Award Winners



McCall

**Samuel McCall** and **Roger Stolen** are among the 1990 winners of Optical Society of America (OSA) awards. The awards will be presented at the OSA's annual meeting, to be held in November.

McCall, DMTS in the Scattering and Low Energy Physics Research Department at Murray Hill, will receive the Max Born Award for achievement in physical optics. He is recognized "for his pioneering theoretical and experimental contributions to self-induced transparency and optical bistability."

Stolen, DMTS in the Laser Science Research Department at Holmdel, will be awarded the R.W. Wood Prize. The prize recognizes an outstanding discovery, scientific or technological achievement, or invention in the field of optics. Stolen is cited "for contributions to polarization control and nonlinear optics."



Stolen