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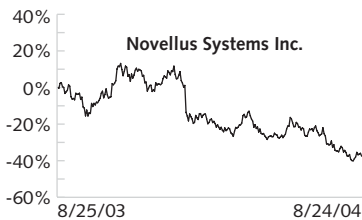
WaferNEWS

THE SEMICONDUCTOR EQUIPMENT AND MATERIALS WEEKLY BRIEFING

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In the spotlight



Percentage change in Novellus Systems stock price, which was \$24.85 on August 24, 2004, compared to \$39.79 a year ago. See story at right.

WaferNews source: FinancialContent Inc.

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PART 1

The CMP sector shows signs of maturity

Two new planarization platforms were introduced prior to and during SEMICON West last month: Xceda by Novellus, San Jose, CA, and the Reflexion LK Ecmp by Applied Materials, Santa Clara, CA. Both platforms clearly focus on reducing costs, a sign of a maturing CMP market.

"The Ecmp platform offered by Applied has the potential to significantly lower the cost of copper CMP processes," Tom Tucker, president, Laredo Technologies, told *WaferNews*. He added that the Novellus platform, because of its through-pad slurry delivery capability and abrasive-free slurries, also offers the potential of significant cost reduction compared to conventional CMP.

"The market shares looking forward will depend on industry fundamentals: low cost of ownership, reliability, enabling technology, and customer support, said Tucker. "At this stage, Applied appears to have the edge."

Debra Vogler, Senior Editor

How will these offerings fare in an industry that is rushing from 90nm, to 65nm, and even 45nm (see *WaferNews*, V11n33, August 16, 2004)? Dean Freeman, principal analyst, Gartner Dataquest, believes the next technology insertion point for CMP is at the 45nm node, yet both the Applied and Novellus tools target the 65nm node. "If you look at the current market share breakdown, Applied had 62.4% share in 2003 and has had >60% share for the past five years," said Freeman. "Ebara had a 27% share in 2003, and the Novellus share was 3%. Novellus will need to be able to penetrate accounts and win the production buys, which might be difficult as supposedly many 65nm buys have already been set at the leading companies."

A closer look

The Xceda features touted by Novellus chairman and CEO Rick Hill include a through-pad direct slurry distribution,

See **CMP** continued on page 10

China's push for "innovation" is a myth

Don't believe everything you hear about China. Peeling back the veneer of myths surrounding the big buildup in high tech there reveals a country continuing to push copycat technology and theft of intellectual property in order to spur growth, according to Anne Stevenson-Yang, managing director of the US Information Technology Organization (USITO), a trade association for US telecom, semiconductor, software, and electronics industries. She spoke at a session last month during SEMICON West.

While there has been a massive boom in

Bob Haavind, Editorial Director

fab building, especially in Shanghai, almost all the chips made in China are designed elsewhere. Therefore, China's government has been pushing rapid growth in the design sector, providing about a third of the capital for new companies while also pushing policies to get the chip industry to invest in design, according to Stevenson-Yang. She said there were 468 design companies in February 2004, up 100 in a year. Of these, 30 have sales over RMB 10 million (about \$1.2 million), and the average sales growth for existing design firms was 107% last year. This has created demand for skilled engineers running far ahead of supply. The Chinese aim to get

See **CHINA** continued on page 6

SEMI: July equipment demand slows, but stable growth bodes well

Demand for semiconductor manufacturing equipment remains strong, although clearly it's slowing down—but don't reach for the panic button just yet, according to SEMI.

North American-based manufacturers of semiconductor equipment reported orders of \$1.61 billion in July 2004, matching the slightly revised total for June (\$1.61 billion), and a 128% increase from July 2003 (\$706.9 million), according to SEMI. The bookings, representing a three-month moving average, have increased sequentially 10 out of 11 months, attaining their highest level since early 2001.

Worldwide billings in July were \$1.54 billion, rising slightly from June (\$1.50 billion) and double the billing levels from a year ago (\$785.9 million). Billings have steadily increased month-on-month for 12 consecutive months, with seven consecutive



WaferNews source: SEMI

months of year-on-year growth. Through July, bookings for 2004 were \$10.28 billion, up 98% from the same period in 2003; billings of \$9.28 billion were 65%

See SEMI continued on page 7

IC unit growth, process complexity drive up resist sales

The field of photoresist suppliers continues to jockey for top positions as the resist business moves through its third straight year of growth after the 2001 downturn. Resist revenues in 2004 are expected to rise 10.3% to \$869.1 million, surpassing the previous peak set in 2000 at \$859.4 million, according to a recent forecast by Gartner Inc.

The growth cycle in resist sales will con-

tinue in 2005 with worldwide revenues increasing another 11.5% to \$966.6 million, said Gartner's Dataquest unit in San Jose, CA. Following a 3.1% dip in 1996, resist revenues will begin climbing again in 2007 and cross the \$1 billion mark for the first time since 1998—\$1.06 billion, according to the new forecast.

Resist consumption is getting a boost

See RESIST continued on page 8

Scorecard for the top 10 resist suppliers

2003	2002	Supplier	2002 sales (US \$M)	2003 sales (US \$M)	% change	2003 share (%)
1	1	Tokyo Ohka Kogyo	158.0	169.8	+7.5	21.6
2	3	JSR	135.3	163.1	+20.5	20.7
3	2	Rohm and Haas*	136.4	148.5	+8.9	18.9
4	4	Arch Consolidated	86.3	101.2	+17.2	12.8
5	6	Sumitomo Chemical	55.6	70.3	+26.4	8.9
6	5	Shin-Etsu Chemical	65.9	62.7	-4.9	8.0
7	7	Clariant	44.9	47.8	+6.5	6.1
8	8	Dongwoo Fine Chemicals	7.1	11.7	+64.1	1.5
9	9	Dongjin Semiconductor Chemicals	6.5	8.6	+32.0	1.1
10	10	Nippon Zeon	3.2	2.9	-8.0	0.4
Total			701.4	787.6	+12.3	100.0

*Formerly Shipley Co. WaferNews source: Gartner Dataquest

Briefs...

ASMI setting up Singapore wafer tool plant—ASM International, Bilthoven, The Netherlands, plans to invest more than \$29 million to set up Singapore's first wafer-processing equipment facility. The plant in Yishun will produce its own parts or source locally, and assemble generic subsystems for vertical diffusion furnaces currently handled by ASMI's Dutch contractors, starting with the A412 system (full production slated for mid-2005). The facility also will provide manufacturing support to ASMI's US and Japanese subsidiaries. The company is targeting domestic shipments of 100 systems by the end of 2006.

It's official: Hynix signs on for China plant—Hynix Semiconductor has signed a formal contract to set up a pair of chipmaking facilities in Wuxi, China, in partnership with STMicroelectronics and the Chinese provincial government. Construction of an \$800 million 200mm wafer facility, followed by a \$1.2 billion 300mm facility, will be completed by 2H05, with mass production beginning in 2006.

Japan firm boosting photomask production—Nippon Filcon Co. plans to increase its photomask production capacity by more than 20%, according to the Nihon Keizai Shimbun. The company will spend ¥500 million (\$4.6 million) to bring a new facility in Tokyo Prefecture online by the end of 2005, with output capacity of 2400 127mm photomasks/month. Nippon plans to concentrate on commodity masks for products including LEDs and transistors, in order to avoid competing with larger photomask vendors, such as Dai Nippon Printing Co.

Briefs...

ARM snaps up Artisan in design deal—UK-based ARM Holdings has agreed to acquire Artisan Components Inc., Sunnyvale, CA, for approximately \$913 million in cash and stock. The deal broadens ARM's SoC business and IP, as well as its sales channel. ARM CEO Warren East will continue as CEO of the combined entity; Artisan chair Lucio Lanza and president/CEO Mark Templeton will become directors.

OnWafer scores \$7M from VCs—OnWafer Technologies, Dublin, CA, a provider of measurement and control systems, has closed a \$7 million Series C round of VC funding, led by Newbury Ventures, Mohr Davidow Ventures, and ITU Ventures. The funds will be used to expand the company's support and operations infrastructure and for new product development.

MII adds TEL to investors—Molecular Imprints Inc., Austin, TX, a manufacturer of step-and-flash imprint lithography, said Tokyo Electron Ltd. (TEL) has made an unspecified contribution to the company's Series B funding round. "This is an excellent opportunity for TEL to be more closely attuned to emerging nanotechnology developments," stated TEL president and CEO Ken Sato.

Electroglas sees 3Q04 bump—Electroglas Inc., San Jose, CA, a supplier of wafer probing and test handling systems, said a new agreement with former parent company General Signal Corp. will result in a one-time gain of \$8.25 million in its 3Q04 ending September 30. The windfall concerns a reduction of payments under a tax benefits sharing arrangement.

Financial Digest

	This Year	Last Year	% Change
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Cohu Inc.
Poway, CA
2Q04 ended June 30

Revenue	\$47.3M	\$32.1M	47.5%
Income	\$6.9M	\$4.1M	
EPS	\$0.32	\$0.19	

Sequentially, revenues rose 32%, while profits more than tripled. For the period through June, Cohu posted a net income of \$9.0 million on sales of \$83.3 million, compared with earnings of \$2.7 million and \$63.2 million in revenues. Orders for 2Q04 were \$59.9 million, up slightly from \$58.2 million in 1Q04, while the backlog grew 21% sequentially to \$72.4 million. Costs were reduced by 10 percentage points to 55.8% of sales; for 1H04, costs were down to 57.0% of sales. Also helping profits were improved gross margins in the company's IC test handling business, according to president and CEO James Donahue. Results for 2Q03 include a \$2.5 million charge for writedowns.

Helix Technology Corp.

Mansfield, MA
2Q04 ended July 2

Revenue	\$44.0M	\$24.6M	79.3%
Income	\$6.4M	(\$1.4M)	
EPS	\$0.24	(\$0.05)	

Revenues for 1H04 grew 75% from 1H03 to \$84.4 million, turning a \$2.8 million net loss

	This Year	Last Year	% Change
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into an \$11.0 million profit. Sequentially, sales were up 9%, and net income increased 36%. The jump in sales from 2Q03 to 2Q04 far outpaced a 50% increase in costs, while R&D and SG&A investments were nearly flat. President and CEO Robert Lepofsky credited high factory utilization rates and customers' strategic investments for creating "very favorable market conditions."

Lam Research Corp.

Fremont, CA
4Q04 ended June 27

Revenue	\$329.6M	\$186.1M	77.1%
Income	\$52.7M	\$3.7M	
EPS	\$0.38	\$0.03	

In the prior quarter, Lam reported a profit of \$19.2 million on sales of \$231.1 million. For FY04, Lam posted a profit of \$83.0 million on sales of \$935.9 million, compared with a net loss of \$7.7 million on sales of \$755.2 million in fiscal 2003. Gross margins were 48.3% in 4Q, up from 45.9% in 3Q and 41.4% in 4Q03. 4Q04 results include a \$3.0 million charge associated with termination of its CMP systems development, announced in July. New orders increased 17% year-on-year to \$408 million, with nearly two-thirds from the Asia-Pacific region. Europe actually outpaced both Japan and North America in terms of 4Q revenue, with 16% of overall sales.

Backend consolidation story takes another twist

ChipMOS Technologies Inc. has agreed to purchase all of the testing and assembly assets of First International Computer Testing and Assembly Technology Inc. (FICTA) located in the Hsinchu Science Park in Taiwan (FICTA has two operations in Taiwan and a third in the US). The \$30 million deal will boost ChipMOS' capacity for assembly/testing memory products to 12 million pieces/month, according to Chairman and CEO S.J. Cheng. Also, ChipMOS plans to move some of the equipment, including wafer testers, final testers, and assembly equipment for memory products, to an overseas facility in order to ramp production there.

The ChipMOS/FICTA agreement marks the latest move in a series of consolidations in the backend semiconductor production

segment. On August 24, Amkor Technology Inc. completed its \$71 million purchase of Unitive Inc., targeting wafer-level packaging and 300mm bumping. On August 4, ST Assembly Test Services (STATS) finalized its \$1.6 billion acquisition of Fremont, CA-based ChipPAC Inc.

Recent backend deals also have crossed party lines. Earlier this year FICTA sold a 354,000 sq. ft. assembly and test facility in Taiwan to Amkor for \$42 million, which will be used for its flip-chip production lines. And in the past week, STATS/ChipPAC announced it has hired Scott Jewler as its new chief strategy officer, responsible for product line management and market and technology strategy—he was most recently president of Amkor's Taiwan operations. — J.M.

B I T L I N E S

Lunch to whales, but batteries to us—

Last week WaferNews highlighted MIT researchers investigating proteins from spinach as the basis for powering future electronic devices. This week we spotlight a team from Oregon State U. that's exploring how to power devices using an even odder source: plankton, the microscopic food source of many aquatic creatures. The group, led by Clare Reimers, professor in the school's College of Oceanographic and Atmospheric Sciences, already had developed fuel cells that take advantage of how decaying organic matter in the sea floor causes electrons to flow. That's best suited for powering stationary equipment such as hydrophones or earthquake-monitoring devices, according to Reimers. New research, still in its infancy, indicates decomposing microorganisms can be used to shuttle electrons to fuel cell electrodes—generating electricity that could support a new class of underwater devices that glide through the water, scooping up plankton that would decompose internally and be converted to energy. One example: sensor-laden robots to map the ocean's changing chemical and physical properties. The energy output isn't eye-popping—about a cupful of concentrated plankton would generate electricity equal to a c-cell battery—but such a ubiquitous, renewable energy source would be enough to power smaller devices for months or even years. The scientists are working to improve the energy-efficient means of collection and concentration and boost conversion efficiency (currently about 10%), as well as address the corrosive nature of seawater on electrical contacts.

On the lookout for nonconformists—

Woe be unto electronics parts that don't follow industry rules, because now they are being watched. The Independent Distributors of Electronics Association (IDEA),

a nonprofit trade association representing distributors, has established a "Nonconforming Parts Board," accessible online, that allows members to track nonconforming parts circulating in the channel, and submit alerts about new ones. IDEA members can track items by manufacturer name, part number, production date and lot code, as well as the reason for submission (e.g., the part fails electrically). Currently 600 items are listed, and IDEA anticipates thousands eventually will be listed. "This type of 'heads up' alert will help ensure that our members are protected and therefore less likely to fall victim to buying substandard parts," stated IDA president Nick Davis.

The next IC frontier: curing medical malpractice—

Integrated circuit technology is ubiquitous, but here's another application being evaluated in Japan: medical license cards to provide information about doctors. The nation's health ministry is conducting a feasibility study for development of a card incorporating a built-in IC, containing information on a doctor's specialization and work record, according to an *Associated Press* story. The card, about the size of a bank ATM card, also would include standard data such as D.O.B., photo, and an ID number. Medical practitioners would be required to swipe the card in order to have their information checked by a computer, before beginning work. The goal of the program would be to improve service efficiency, and possibly reduce medical malpractice, "though we need to think about many things such as protecting personal information while taking the opinions of medical associations and hospitals into consideration," according to one official. *WaferNews* has another idea for the card's use: Evaluate doctors in terms of legibility of their famously scribbled signatures.

Briefs...

Axcelis signs Aspect for etch line—Aspect Systems Inc. (ASI), Chandler, AZ, has purchased licenses to manufacture, sell, and service all of Axcelis Technologies' Bobcat 209 and Cheetah reactive ion etch (RIE) legacy product models. The deal (terms were not disclosed) calls for ASI to assume service and parts support for all of Axcelis' 150mm and 200mm RIE systems as of September 30. ASI has manufactured and supported Axcelis' Matrix System One and System Ten platforms since November 2003.

Nanophase pulls back share offering—Nanophase Technologies Corp., Romeoville, IL, is withdrawing a planned shelf registration, citing a "general decline in equity markets" since its initial filing in January. Joseph Cross, company president and CEO, added that the company's current cash position should cover growth through 2006.

TSMC files another suit against SMIC—Taiwan Semiconductor Manufacturing Co. (TSMC) has filed a lawsuit in Taiwan against Chinese foundry Semiconductor Manufacturing International Co. (SMIC), accusing it of infringing upon three more patents. TSMC filed a similar complaint in December 2003 in the US.

Nat'l Semi sells imaging business to Kodak—National Semiconductor Corp., Santa Clara, CA, has sold its imaging business to Eastman Kodak Co. for an undisclosed amount. The assets, including equipment, IP, and about 50 employees, will become part of Kodak's Image Sensor Solutions business. With the deal, National Semi will focus on core analog capabilities, while Kodak gains CMOS image sensor expertise.

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Briefs...

CSMC to build 200mm plant in China—Chinese chipmaker CSMC Technology Corp. has finalized a deal to build an \$80 million plant in Wuxi. The facility, to be completed by the end of 2005, will boast two 200mm production lines with total output of 60,000 wafers/month. Wuxi also will be the site of a \$2 billion chipmaking JV between Hynix and STMicroelectronics, announced earlier this month.

Oregon to receive litho system—The U. of Oregon has received \$402,000 from the National Science Foundation for new electron-beam lithography and nanoimprint lithography systems. The tools will be used for nanofabrication research through the statewide Oregon Nanoscience and Microtechnologies Institute, and shared among UO, Oregon State U., and Portland State U., as well as the Pacific Northwest National Laboratory in Richland, WA.

Tower class-action suit dismissed—A class-action lawsuit brought against Israeli chipmaker Tower Semiconductor and some of its directors and shareholders has been dismissed, the company said. A US Court in New York indicated that Tower et al. are exempt due to the company's status as a foreign private issuer under SEC rules.

RF Micro expands in China—RF Micro Devices Inc., Greensboro, NC, a provider of radio-frequency (RF) ICs, has opened a sales and support office in Shenzhen, China, to support local manufacturers and original design/equipment manufacturers.

CHINA *continued from page 1*

rid of analog TV and go all-digital by 2010, although the standards that will be used are not yet clear. Many of the design projects are aimed at consumer chips, including those in cameras, DSPs and power controllers for cell phones, and at broadband devices.

A closer look at Project 863 for government-supported chip design, however, reveals that the major push is to replicate existing foreign chips rather than building on an international foundation to create new value, Stevenson-Yang said. As an example, she said one project aimed to imitate Intel's 450 CPU. Also, national funding for R&D has been shifting away from basic research. She indicated that while basic research funding has grown only 7.4% since 2001, funding for applied research has grown 24.7%—and for commercial development it's up 96.7%, boosting that segment to over 75% of total R&D spending.

In spite of the government's claims of stronger legal measures against stealing IP, the number of infringement cases are increasing rather than decreasing. She cited numerous cases: Toyota vs. Geely, GM vs. Chery, Cisco vs. Huawei, Lacoste vs. Crocodile Garments, Pepsico vs. Sichuan Yunlu, and more. China's own Information Technology Ministry estimates that 95% of software used in computers there is pirated, she added. Even though she believes many Chinese business and technical people would like to do more innovative work, the super-growth targets and policies pushed by the government force the companies to use copycat technology or even to steal existing intellectual property. She feels that the government is often pushing in the wrong direction, in spite of official pronouncements, trying to redefine IP internationally and force new standards to favor Chinese vendors so they don't have to pay licensing fees. The bureaucracy also offers incentives to

reward companies that can displace foreign chips.

One strategy now being employed to obtain foreign IP is to hire whole development teams, rather than acquiring overseas companies or licensing their technology, she said. In some cases, Chinese companies refuse to license patents, and then try to standardize on their own designs, which do not work as well.

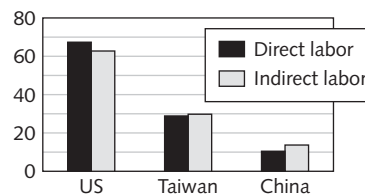
She also pointed out that the structure of the Chinese economy has given companies the ability to compete cheaply by stripping all tangible value out of products. The estimated annual cost of environmental degradation is 8% of GDP. There are about 130,000 workplace deaths annually, according to Stevenson-

Yang, and there are very low payment standards for liability settlements. She cited 470 injuries from exploding beer bottles in the summer of 2003, among other examples. Aside from software piracy, there is rampant pharmaceutical counterfeiting, and trademark infringements.

Instead of addressing environmental and health issues, the government has greatly increased investments in infrastructure, such as roads, bridges, universities, training institutes, and others that can help to accelerate economic development, according to Stevenson-Yang.

Chinese industrial policy has greatly sped the growth of the semiconductor sector, so that investments over the 2001-2005 period, expected to be some \$10 billion (about half for foundries) will exceed those of the past 30 years. The China market for fab equipment reached \$1.16 billion in 2003, up 5.5% for the year. Of that, \$953 billion was for wafer processing, mask/reticle, and factory automation equipment, while \$203 billion was for test/assembly/packaging equipment. New fabs now being built will achieve 0.18µm features. The projected semiconductor investment in 2005 is \$4.2 billion, she added. — B.H.

Differential labor costs* in semiconductor manufacturing (\$US M)**



* China's nominal labor costs in semiconductor manufacturing are 16% of those in the US. Nominal costs, however, may exclude a number of factors, such as benefits loading and higher-than-US-prices paid for top executives.

** Assumes 8000 200mm wafer starts/week, productivity estimates excluded

Digest of recent equipment and materials orders

Vendor	Customer/Location	Equipment	Value	Ship date
Aixtron	Lumileds	Epi systems	N/A	N/A
Applied Materials	Silterra Malaysia	Dielectric deposition, etch, barrier/seed, electrochemical plating, CMP, defect inspection systems	N/A	3Q04-1Q05
BOC Edwards	Hannstar, 300mm foundry/Taiwan	Bulk special gas systems	N/A	N/A
Brooks Automation	300mm semiconductor foundry/Japan	Automation system	Multimillion-dollar	N/A
Cimetrix	Nanophotonics/Germany	300mm connectivity software	N/A	Has been installed
Cimetrix	Molecular Imprints	300mm connectivity software	N/A	N/A
Cymer	Unidentified lithography systems provider	KrF light source	N/A	July 2004
Dai Nippon Printing Co.	ProMOS Technologies	90nm masks	N/A	N/A
GSI Lumonics	IC manufacturer/US	Laser trim systems	\$6 million	3Q04
ICOS Vision Systems	Unidentified customer	Board-level OEM products	€10 million	1Q05
Knights Technology	AMD 300mm fab/Dresden, Germany	Yield management software	N/A	N/A
LTX	Silicon Turnkey Solutions	SoC device test systems	N/A	N/A

SEMI continued from page 3
ahead of last year.

The book-to-bill ratio (B:B) in July was 1.05, compared with 1.07 in June and 0.90 a year ago. A B:B of 1.05 means that \$105 worth of new orders were received for every \$100 of product billed for the month. The B:B ratio has achieved its tenth consecutive month above parity.

While equipment demand remains at high levels, clearly it's slowing down. Orders, which grew sequentially at an 11% clip in

January, were down to just over 2% in July, while comparable sales growth over the same period has been cut from high single-digits to just a fraction of a point. The B:B ratio, which plots a balance between orders and sales, has declined seven straight months from a two-year high of 1.23. Jonathan Davis, SEMI's VP of communications, said that the glass is still half-full. "We're characterizing this as stable growth at very high levels," he said. "This may well be healthy in the long term of the industry."

Briefs...

SIA issues call for fab safety study—The Semiconductor Industry Association (SIA) is soliciting proposals for an independent study of cancer risk among US semiconductor wafer-fab workers from the 1960s to the present. The study, reviewing data on more than 200,000 workers following the recommendations of an advisory committee formed in 1999, is open to RFPs from public and private institutions including universities, laboratories, and government agencies. It is expected to begin in 1Q05, and take three to five years to complete.

Feinfocus tabs German director—Feinfocus, manufacturer of x-ray inspection systems, has appointed Frank Gitmans as managing director of its global headquarters in Garbsen, Germany, responsible for R&D, manufacturing, sales, and profitability. Gitmans was most recently managing director of German machine tool company Peter Wolters Surface Technologies.

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Applied beeps up services with Metron buy
Metron expanded beyond its semiconductor spin-off equipment portfolio with the company's growing fab services program as well as supporting hardware and materials. Applied Materials Inc., Santa Clara, CA, has agreed to acquire Netherlands-based Metron Technology N.V., including operating subsidiaries and businesses, for \$48 million and assumption of liabilities. The deal is expected to close in November (Applied's fiscal Q4). Metron (NASDAQ: MTRON) offers a range of enhanced fab services covering parts and materials supply, equipment maintenance, and refurbishment of legacy equipment, with several operating facilities in the US, Europe, Israel, and Asia. Applied will become a wholly owned subsidiary of Applied, retaining the Metron name and name recognition. *News Editor: J. Robert (rjacob), Senior Editor: J. Robert (rjacob), Senior Editor: J. Robert (rjacob)*

Benchmarking the industry: New reporting rules help spike sales for top Japanese suppliers
Japan's leading cluster suppliers reported their total sales of semiconductor equipment and materials jumped 80% in the June quarter over the year before, while their aggregate operating margin reached 15%. The June quarter was the first time most Japanese companies have reported quarterly results, to meet changing disclosure requirements. Advanced led the pack with a 100% jump in revenues in fiscal 2004 compared with the year before, although Hitachi, Rohm, Tokai, and TDK also reported strong growth. Other suppliers include: Dainippon Screen, and Hitachi High-Technologies. *News Editor: J. Robert (rjacob), Senior Editor: J. Robert (rjacob)*

Denali Engineering Only materials suppliers saw anything over their 40% growth, although some of them did see more than 20% improvement. That strong recovery pushed seven equipment makers above \$400 million in quarterly sales. WaferNews hasn't compiled Q2 results yet for the rest of the world, but in the first quarter, only Applied, ASM, and Tsinghua broke the \$400 million mark in the US and Europe. The supplier applies also all made money on operations in their semiconductor business, except for Nikon. Indeed, everyone except the lithography suppliers and smaller silicon-wafer manufacturers made more than \$10 million in sales on each dollar of sales for the June quarter. *Dr. Paul Zbar, Contributing Editor*

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Briefs...

Cymer to tweak shareholder plan—Cymer Inc., San Diego, CA, a supplier of deep-ultraviolet (DUV) lithography light sources, said it is accelerating the termination date of its shareholder rights plan from Feb. 13, 2008 to September 1, 2004. Such plans often are used as “poison pills” to discourage unwanted acquisitions.

Florida college gains EUV tools—Northrop Grumman Corp. has donated equipment and intellectual property to the U. of Central Florida’s College of Optics and Photonics to support its ongoing research into extreme-ultraviolet (EUV) lithography for semiconductor manufacturing. The gift, valued at about \$24 million, is the largest donation in the university’s history. The school began its EUV research in 1990 with early studies of laser plasmas and EUV source and optics development.

RESIST *continued from page 3*

from the growing number of mask layers needed to produce leading-edge ICs, but larger 300mm wafers also are making processes more efficient and reducing material requirements, said analyst Klaus Rinnen, VP for Gartner Dataquest’s semiconductor manufacturing and design research group. “The strong growth in semiconductor units over the past couple of years has helped to drive up [resist] volume demand,” he noted.

“The photoresist market is also facing more pricing pressure, partly due to the competitive nature in consumer IC applications and tough negotiations in Asia,” Rinnen added. A recent report from Gartner Dataquest showed resist revenues surged 26.1% in the fast-growing Asia Pacific region during 2003, compared with an increase of 12.3% worldwide.

Of the four suppliers with revenue over \$100 million, Tokyo Ohka Kogyo held onto the No. 1 position, according to the research

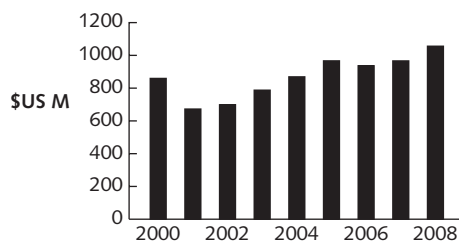
firm’s market share report. Tokyo-based JSR Corp. pulled into the No. 2 slot ahead of Rohm and Haas, with 20.5% growth in 2003—the strongest growth within this group—driven by its strength in deep-ultraviolet resists, Gartner Dataquest said.

Looking ahead, the competitive resist

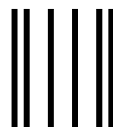
field continues to change. This fall, Swiss chemical giant Clariant International AG expects to complete its \$412 million sale of AZ Electronic Materials to The Carlyle Group, part of Clariant’s efforts to narrow its focus

on core businesses. AZ Electronic Materials, a supplier of photoresists, developers, and strippers to semiconductor and LCD manufacturers, accounted for about \$351 million revenues in 2003, vaulting Clariant to seventh place in photoresist sales last year. The Carlyle Group has promised to continue investments for growth in the business, including expansion in Taiwan and site development in mainland China. — J.R.L.

Resist business moves to \$1 billion mark



WaferNews source: Gartner Dataquest



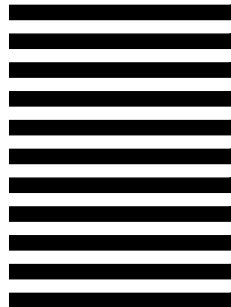
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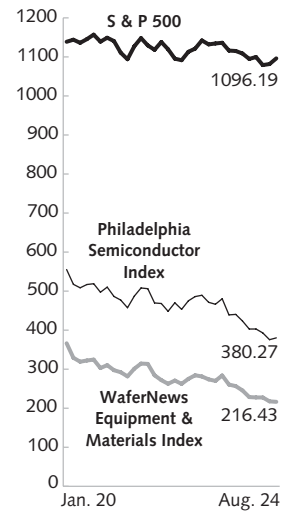
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The WaferNews Fab 50

	Close 08/24/04	Close 08/17/04	Net Change	% Change Week	% Change YTD	P/E Ratio	52-Week High	52-Week Low	Market Cap (\$M)
Semiconductor Equipment									
ADE Corp	15.45	15.79	-0.34	-2.15%	-16.57%	24.9	25.79	14.65	216
Applied Materials	15.93	16.07	-0.14	-0.87%	-29.01%	61.3	25.94	15.36	26993
ASM International	14.35	14.24	0.11	0.77%	-29.10%	-84.9	27.90	13.44	721
ASM Lithography	13.39	13.45	-0.06	-0.45%	-33.22%	66.9	22.67	12.33	6464
Asyst	4.73	4.44	0.29	6.53%	-72.56%	-2.4	20.24	4.15	223
Axcelis Technologies	8.76	8.28	0.48	5.80%	-14.70%	-9.1	13.26	7.67	871
Brooks Automation	13.06	12.40	0.66	5.32%	-44.99%	-5.4	28.10	11.50	582
Electroglas	2.61	2.65	-0.04	-1.51%	-28.49%	-1.5	6.17	1.77	57
FEI Company	19.01	17.65	1.36	7.71%	-15.51%	90.5	28.75	16.66	632
FSI International	4.83	4.67	0.16	3.43%	-34.55%	-30.2	9.24	4.01	144
Genus	2.02	1.93	0.09	4.66%	-66.33%	-12.6	7.50	1.80	80
KLA-Tencor	37.01	36.55	0.46	1.26%	-36.78%	42.5	62.82	35.02	7275
Kulicke & Soffa	5.53	5.25	0.28	5.33%	-61.54%	-15.8	17.20	4.80	281
Lam Research	21.48	21.01	0.47	2.24%	-33.50%	85.9	35.50	19.71	2868
Mattson Technology	7.48	7.47	0.01	0.13%	-38.18%	-37.4	16.59	5.77	373
Metron Technology	4.45	4.36	0.09	2.06%	2.30%	-3.3	5.20	2.05	57
Micro Component Technology	0.83	0.90	-0.07	-7.78%	-42.36%	-6.4	2.38	0.65	18
Nanometrics	10.31	10.57	-0.26	-2.46%	-29.91%	-13.7	23.50	6.75	126
Novellus	24.85	24.68	0.17	0.69%	-40.90%	-60.6	45.50	23.39	3674
Rudolph Technologies	16.78	15.20	1.58	10.39%	-31.62%	104.9	30.25	13.02	280
Semitool	7.46	7.35	0.11	1.50%	-30.67%	-18.6	15.03	6.76	213
Tegal	1.20	1.09	0.11	10.09%	-56.68%	-2.4	4.05	0.75	44
Teradyne	13.77	13.98	-0.21	-1.50%	-45.89%	-33.6	30.70	13.20	2671
Therma-Wave	3.59	3.43	0.16	4.66%	-39.15%	-6.1	6.98	1.80	127
Trikon Technologies	2.10	1.95	0.15	7.69%	-63.09%	-1.3	7.58	1.83	33
Ultratech	15.11	13.49	1.62	12.01%	-48.55%	40.8	35.55	10.99	358
Varian Semiconductor Equipment Assoc.	29.13	26.81	2.32	8.65%	-33.49%	50.2	51.98	25.61	1056
Veeco	19.97	19.68	0.29	1.47%	-29.08%	-68.9	34.40	18.45	592
Semiconductor Equipment Subsystems									
Advanced Energy Industries	9.85	9.76	0.09	0.92%	-62.19%	-11.1	29.99	7.91	321
Cymer	27.00	25.75	1.25	4.85%	-41.55%	-180.0	50.44	23.81	990
MKS	13.40	13.34	0.06	0.45%	-53.79%	268.0	29.97	12.44	717
Mykrolis Corp.	9.19	8.96	0.23	2.57%	-42.85%	91.9	17.98	8.09	379
Synopsys (L)	15.06	20.30	-5.24	-25.81%	-55.52%	15.9	65.71	14.34	2310
Semiconductor Materials									
ATMI	19.23	18.81	0.42	2.23%	-17.15%	-240.4	30.50	17.78	600
AXT	1.40	1.20	0.20	16.67%	-54.98%	-1.3	4.68	1.05	32
Cabot Microelectronics	33.64	32.69	0.95	2.91%	-31.35%	20.5	67.66	26.02	835
DuPont Photomasks	15.36	15.04	0.32	2.13%	-36.37%	-2.8	28.50	14.36	282
Entegris Inc.	8.39	8.20	0.19	2.32%	-34.71%	46.6	15.66	7.72	614
Ibis Technology	4.03	3.20	0.83	25.94%	-64.18%	-2.0	17.90	3.11	43
Isonics Corp.	1.10	0.95	0.15	15.79%	-5.98%	-3.7	2.17	0.75	17
MEMC	8.54	8.19	0.35	4.27%	-11.23%	14.2	14.51	7.55	1773
Photronics	14.28	13.43	0.85	6.33%	-28.31%	37.6	26.00	12.60	465
Chipmakers									
AMD	11.95	11.38	0.57	5.01%	-19.80%	-49.8	18.50	9.60	4208
IBM	84.71	84.04	0.67	0.80%	-8.60%	18.8	100.43	81.27	141905
Intel	21.67	21.51	0.16	0.75%	-32.39%	22.3	34.60	21.03	140162
LSI Logic	5.05	4.77	0.28	5.87%	-43.07%	-10.7	12.90	4.46	1929
Micron	11.90	11.13	0.77	6.92%	-11.66%	-19.5	18.25	10.89	7266
Motorola	16.01	15.08	0.93	6.17%	14.36%	28.6	20.89	10.22	37530
National Semiconductor	13.84	14.20	-0.36	-2.54%	-29.76%	29.1	24.34	13.05	4965
Texas Instruments	19.69	19.00	0.69	3.63%	-32.98%	24.0	33.98	18.06	34085

Market Diary

Week ending August 24, 2004



Advances	41
Declines	9
Unchanged	0
New Highs	0
New Lows	1
Largest Dollar Gain:	\$2.32 Varian Semi. Equipment Assoc.
Largest Dollar Loser:	(\$5.24) Synopsys (L)
Largest % Gain:	25.94% Ibis Technology
Largest % Loser:	-25.81% Synopsys (L)

(H) = Company hit a new 52-Week High in Period (L) = Company hit a new 52-Week Low in Period

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Briefs...

Wireless SoC firm revamps business—PalmChip Corp., San Jose, CA, a developer of semiconductor IP and system-on-chip (SoC) technology, is launching a new company, PalmChip Semiconductor Inc., to provide chips for wireless storage applications and application specific standard products. PalmChip also has sold its parallel and serial ATA IP to Mentor Graphics Corp. for an undisclosed amount, and opened a new design center in Pakistan.

Accent, Taiwan institute study metrology—Accent Optical Technologies, Bend, OR, a supplier of lattice engineering and photolithography process-control systems, has entered into a partnership with Taiwan's Center for Measurement Standards, Industrial Technology Research Institute, to develop overlay metrology technology. The goal is to achieve overlay measurement precision to the 65nm node, and manufacturing process control of 2nm.

Wafer supplier grows revenues—IQE plc., a UK-based supplier of epitaxial wafers, reported 1H04 sales of \$14.6 million, slightly higher than 2H03 and the first revenue growth in three years. Year-on-year, revenues were off by about 9%, due to ASP declines. The company's wafer technology subsidiary has been profitable in three of the last four months.

Gas supplier names Korea head—Matheson Tri-Gas Inc., Parsippany, NJ, has appointed Yoo Kyung Kim as president of its Korea subsidiary. Kim previously worked for Hanyang Engineering Co, a piping contractor for semiconductor and TFT-LCD fabs, overseeing projects in the US, Malaysia, and China.

CMP continued from page 1

grooved pads for patented micro-channel dispensing, and a multizone carrier that provides flexibility in slurry distribution across the wafer. Eddy current measurements provide data on the fly, and Hill said there is no need for dummy fill or specific patterns. A noncontact cleaner and in situ Cu thickness monitoring along with inline metrology round out the list. The company says the tool is ultralow- κ ready ($\kappa < 2.5$). Novellus also addressed serviceability: Maintenance personnel can actually walk into the tool and change a platen in <90 sec.

Hill has said that Novellus sees Cu CMP as an opportunity to make a paradigm shift in production. The new tool's 95 sq. ft. footprint and estimated 40% savings on slurry costs put the company in contention. Hill said that any end user's slurry and/or pad can be used to get cost savings, but maximum savings come from using the company's recommended approach. The current cost of consumables (CoC) of the Xceda platform is \$11.50/wafer, but Hill said the 4Q04 goal is \$8/wafer.

Applied Materials' platform uses electrolytes as the removal medium instead of slurry for Cu planarization, hence the name Ecmp (electrochemical mechanical planarization, or electrolytic planarization). According to a paper written jointly by IBM, Chartered, Sony Electronics, AMD, Infineon, and Applied¹, Cu removal is directly proportional to the presence of electrical charge using this technology. According to the authors, the process produces a thin, planarized Cu film across all pattern densities across the wafer; excessive dielectric removal for dishing correction is not required. The Cu removal is independent of the applied downforce. A math model that calculated the post-Ecmp Cu profile based on in situ real-time detected current was found to be an accurate predictor of the actual Cu remaining after Ecmp.

According to Liang Y. Chen, CMP division GM at Applied, a high copper removal rate (the higher the voltage, the higher the removal rate) in the near no-shear force regime occurs in areas where the wafer contacts the pad. A very low removal rate is present where there is no pad-to-wafer contact.

After bulk removal of Cu using Ecmp (and with no slurry), the remaining thin planar copper film is removed by low downforce

(~0.6psi) polishing that requires much less slurry than conventional CMP. The company reports a 30% reduction in CoC using an integrated Ecmp process.

Asked about extendibility issues when the industry moves to ultralow- κ (ULK) materials, Konstantin Smekalin, product marketing manager at Applied, explained that the company is carefully monitoring the strength of materials with respect to its CMP technology, and has checked downforce values up to about 2011 ITRS requirements. Smekalin also maintained that the company's CMP process technology is in the safe zone with respect to packaging requirements for some time to come. He noted that even air gaps would have a shell with some mechanical strength, so a zero mechanical strength value would never be reached.

While Applied and Novellus duke it out, ACM Research continues to push its noncontact, stress-free copper polishing technology into the mainstream. David Wang, president and CEO, believes the company's product has an edge, particularly when the industry makes its move to ULK dielectrics. "Most of the damage during Cu CMP occurs once you reach the Cu clear and barrier removal stages," explained Wang. "The ACM process is completely contact-free throughout this critical stage, provided the incoming film is flat, which can be achieved by a partial CMP or a flat plating technique."

Wang argued that other approaches to addressing the concerns of ULK integration and CoC all use conventional CMP for the final clear and barrier removal. "These approaches adversely affect the process step and will become even more critical once ULK materials are adopted." He cited a Selete paper presented at IEDM in 2003 that showed pad pressure can compromise the chain resistance yield in a Cu/low- κ stack. "ACM Research has a model that predicts a 3x weakening of the mechanical strength of a Cu/ULK structure with each technology node migration. Our conclusion is that the Cu removal process for Cu integrated with ULK must be pad-free and stress-free." — D. V.

Next week WaferNews will review Lam Research's CMP experience, and take a look at others in the race.

¹ "Integrated Electro-Chemical Mechanical Planarization (Ecmp) for Future Generation Device Technology," IITC, June 7-9, 2004.

WaferNEWS

C H A R T W A T C H

Order, sales patterns rebut downturn talk

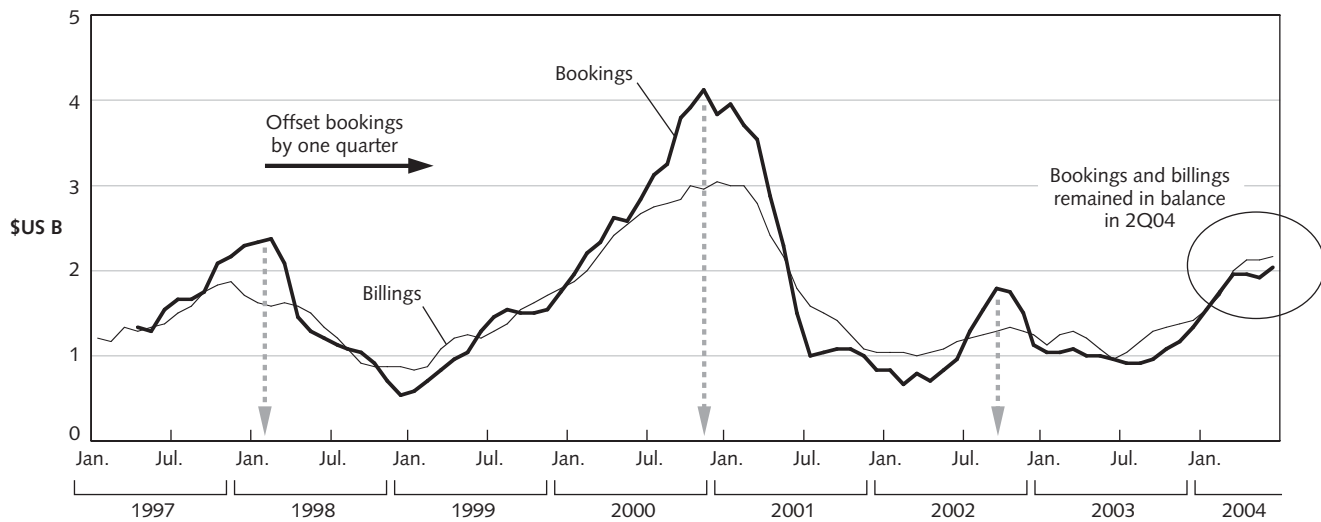
Wall Street's dark outlook on the chip/chip equipment market despite ongoing growth across the industry is merely an issue of short- vs. long-term perspectives, according to SEMI president Stan Meyers.

Nevertheless, SEMI has produced more evidence supporting its side of the argument that

we're not skidding into another downturn. Since 1997, worldwide fab equipment bookings and billings have remained proportionally in-step with a one-quarter offset, a correlation that has been broken only three times: early 1998, fall 2000, and early 2002. For now, bookings and billings are still following that

lockstep model, suggesting a downturn is not yet on the horizon, argued Dan Tracy, SEMI's senior director of industry research and statistics, although he acknowledged slowing demand indicates building backlog and a potential overbooking situation. — J.M.

Worldwide fab equipment backlog monitor
(based on three-month averages)



WaferNews source: SEMI

STAFF

Editor-in-Chief

Kevin R. Fitzgerald (603) 891-9194
e-mail kevinf@pennwell.com

News Editor

James Montgomery (603) 891-9109
e-mail jamesm@pennwell.com

Contributing Editors

Paula Doe
e-mail paulandoe@aol.com

Matt Wickenheiser
e-mail matt_wicken@yahoo.com

Senior Editor, Lithography

M. David Levenson
e-mail marcl@pennwell.com

Senior Editors

Debra Vogler
e-mail debrav@pennwell.com

J. Robert Lineback
e-mail robl@pennwell.com

Publisher

David Barach (603) 891-9413
e-mail davidb@pennwell.com

Senior Vice President

Bill Pryor

Group Editorial Director

Bob Haavind

Circulation Department

Chris Tourgee

Production Manager

Alice Scofield

Marketing Communications Manager

Melissa Kolodziej (603) 891-9169
melissak@pennwell.com

Ad Traffic Manager

Machele Galloway (918) 831-9756

Illustrator

Chris Hipp

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News items, comments and suggestions should be sent to Kevin R. Fitzgerald, phone (603) 891-9194, fax (603) 891-0597, e-mail kevinf@pennwell.com.

Requests for subscription information or bulk orders should be sent to Christine Tourgee, phone (603) 891-9174, fax (603) 891-9350, e-mail christinet@pennwell.com.

Requests for reprints should be sent to Maureen Kane, phone (603) 891-9423, fax (603) 891-9146, e-mail maureenk@pennwell.com

For information on advertising in WaferNews, please contact David Barach, phone (603) 891-9413, e-mail davidb@pennwell.com

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