



## 350 MEMS fabs worldwide !

Over the last few weeks, the launch of different MEMS market surveys have proven that the MEMS market will be a growing market in the years to come. Usually, analysts evaluate market needs and give market data without any interest for manufacturing. Here at Yole, we are interested in both, as commercial and production activities are closely linked.

For this reason, we have identified all the MEMS fabs worldwide to give an idea of the power of this industry. The result is rather surprising. There are more than 350 MEMS fabs worldwide. We have counted all the MEMS production lines, from the integrated MEMS fabs in larger groups, to the "pure" MEMS foundries. All these fabs manufacture all kinds of MEMS: accelerometers, pressure sensors, gyrometers, chemical MEMS, microfluidic chips, optical MEMS, biochips, ink-jet heads, magnetic heads, etc.

Usually, the capacity to over-produce leads to massive lay-offs such as in the semiconductor or optical telecommunication fields. However, this is not the case for MEMS as the numerous applications currently allow many industrial players to survive at the same time. In the future of course, one should be careful about the "me too" syndrome which has so strongly affected the fiber optics telecom business for example.

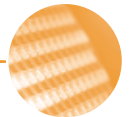
Jean-Christophe ELOY

EDITORIAL

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## List of companies cited in "Micronews"

**SEMICONDUCTORS** Adelante Technologies Agere AMD Applied Materials ARM Dai Nippon Printing Dataquest Dupont Photomasks Ericsson IMEC Infineon Intel L-Tech Mentor Graphic Micron Technology Micronas Motorola NEC Philips Scientific Systems SEMI SEZ SIA ST Microelectronics Starc SZ Testsysteme TSMC UMC UPC Virage Logic VLSI Research X-Fab  
**MEMS** Alcatel Optronics Netherlands CEA-Léti Conexant Dow Chemical EQT Northern Europe Filmtec Générale des Eaux Jazz Semiconductor Memscap PHS MEMS Saab MicroTech Sensoror ST Microelectronics Tronic's Microsystems VTI Hamlin **BIO** Affymetrix Asahi Techno Glass Aviva Biosciences Axon Instruments BioDiscovery Central Research Laboratory (CRL) Daiichi Gyros Illumina Kratos Analytical Luminex Motorola NovusGene Olympus Optical Olympus Promarketing Prolinx Qiagen Samsung, Advanced Institute of Technology (SAIT) Sequenom Tecan **OPTICS** Alcatel Optronics Austriamicrosystems Cisilias A/S Corvis-Algety Digital & Lightwave Technology Eblana Photonics Essient Photonics Heptagon Ibsen Photonics Ionas A/S Memscap NKT Holding AS NKT Integration Pirelli Teem Photonics

## North American Semiconductor Equipment Industry Posts May 2002 Book-to-Bill Ratio of 1.26

The North American-based manufacturers of semiconductor equipment posted a book-to-bill ratio of 1.26.

"For the second month in a row, bookings have shown positive year-over-year growth and, for the first time since March 2001, average bookings have reached above the billion-dollar mark," said Stanley Myers, president and CEO of SEMI. "Recent forecasts showing expectations of low, single-digit growth for the chip market in 2002, suggest we will see continued sequential improvement in semiconductor capital spending with a more robust market anticipated in late 2002 or early 2003."

	Billings (Three-month avg.)	Bookings (Three-month avg.)	Book-to-Bill
April 2002 (final)	814.6	995.6	1.22
May 2002 (prelim.)	861.7	1,084.0	1.26

The SEMI book-to-bill is a ratio of three-month moving average bookings to three-month moving average billings for the North American semiconductor equipment industry. Billing and booking figures are in millions of U.S. dollars

VLSI Research announced a book-to-bill ratio of 1.16 for the worldwide chip-equipment business, down from 1.31 in April.

Billings for this industry were \$2.64 billion in May, while bookings were at \$3.07 billion. For June, VLSI expects a book-to-bill ratio of 1.3, for billings of \$2.6 billion and bookings of almost \$3.4 billion.

<http://www.semi.org> - <http://www.vlsiresearch.com>

## Semiconductor equipment supplier top ranking for Q1 2002

VLSI Research unveiled its top 5 ranking equipment suppliers in the first quarter of 2002.

Rank	Company	Country	Sales in Q1 2002
1	Applied Materials	US	\$1.052 billion
2	Tokyo Electron Ltd	Japan	\$581 million
3	Nikon	Japan	\$364 million
4	KLA-Tencor	US	\$353 million
5	ASML	The Netherlands	\$341 million

According to VLSI's top ranking for the year 2001, the five companies remained in the same place in the Q1 2002.

<http://www.vlsiresearch.com>

## New 2002 IC-equipment forecast from VLSI Research

The San Jose-based market research firm, VLSI Research Inc., projected that the worldwide chip-equipment business will increase from \$36.89 billion in terms of sales in 2002, to \$100.25 billion by 2007, a compound annual growth rate (CAGR) of 22%. The firm raised its forecast to \$36.89 billion for this year compared to \$34.56 billion forecasted one month ago.

### Equipment markets:

	Sales in 2002	Sales in 2007	CAGR
Front-end	\$21.71 billion	\$59.15 billion	22.2%
IC test market	\$8.04 billion	\$24 billion	24.5%
assembly-equipment market	\$2.43 billion	\$8.47 billion	28.4%
Spare parts and service arena	\$4.71 billion	\$8.63 billion	28.4%
Total	\$36.89 billion	\$100.25 billion	22%

VLSI Research forecasted that equipment revenues will resume in 2003 and will peak in 2004. A slowdown is expected in 2005, followed by a recovery in 2006 and 2007.

<http://www.vlsiresearch.com>

## Optical Switch Market Declines 9% in 1Q02

According to a recently released Dell'Oro Group report, the Optical Switch Market declined sequentially 9% to \$116 million in 1Q02. The report also indicates that the market is expected to decline for the full year 2002, after growing almost 600% in 2001. The Optical Switch Report includes optical wavelength and sub-wavelength switches that can manage a large number of optical signals on a single platform.

Vendor	Rank
Tellium	1
Ciena	2
Alcatel	3

# Technologies and Market Trends in SiC

## A dual market

SiC was first used for its mechanical properties. However, in the 90's, the possibility to produce SiC ingots opened new applications in the fields of power electronics and optoelectronics. In power electronics, SiC is used to manufacture chips. In optoelectronics, SiC is used as a substrate to grow GaN films. In this case, the component is not in SiC. The use of SiC as a substrate for GaN growth can also be used to realize power electronic components in GaN/SiC. Thus, SiC is both a material and component market.

## An annual production of 150 000 to 200 000 wafers

There are many different types of SiC: the most common are the SiC 4H, SiC 6H and SiC 3C (or "cubic"). Depending on the final application (power electronics or optoelectronics), different types will be used: the 4H is used in power electronics and the 6H / 3C

is used as a substrate for GaN growth in optoelectronic applications. Growing SiC ingots can be done using 4 methods:

1. Sublimation: this is the most used process. SiC powder is sublimated within a temperature range of 2200 – 2500°C. A germ is used to grow the ingot.
2. HT CVD: it is a high temperature CVD process (2100 – 2300°C). The gas used must contain Si (silane) and C (methane, propane).
3. Conversion: this method turns a Si wafer into a SiC wafer. A first layer of SiC is deposited on a Si substrate using CVD (1450 – 1500°C). Then high temperature (1800 – 2000°C) LPE (Liquid Phase Epitaxy) under carbon atmosphere creates C-Si bondings in the bulk of the Si substrate.
4. Heteroepitaxy of SiC on Si: this process gives SiC 3C wafers and is currently in R&D. It should allow large-size wafers to be realized.

Figure 1 shows the different characteristics of the 4 different processes.

	Sublimation	HT CVD	Conversion	SiC/Si
Typical growth rate	200 µm/h	300 µm/h	100 µm/h	3 mm/h
Growing temperature	2200 to 2500°C	2100 to 2300°C	1450 to 1500°C	Less than 400°C
Type	4H & 6H	4H & 6H	3C	3C
Main players	Cree (US) / SiCrystal (D) II-VI (US) / Umicore-Sterling (B) Nippon Steel (JP) / Sixon (JP)	Okmetic (SE)	CRHEA (lab, F)	Hoya (JP)

Figure 1: Characteristics of the different SiC manufacturing processes

Today, there are 8 industrial players worldwide who propose SiC wafers. The annual production is estimated to range between 150 000 to 200 000 wafers, mainly 2", and using the sublimation process. The four main materials suppliers are Cree, Umicore-Sterling, Nippon Steel and SiCrystal. Figure 2 shows the segmentation of SiC material.

## SiC components: better performance than Si components

SiC is a member of the "compound" semiconductor family (like InP, GaAs or GaN). In 2000, the market for compound semiconductors was 7% of the total semiconductor market (\$200 B). Next year, this market is estimated to be 10 % of the total semiconductor market (or \$300 B).

There are three segments of components manufactured with SiC:

1. SiC components. SiC is the "active" electronic material of the chip. It is mainly SiC 4H which is used, and the components are

Schottky rectifiers or bipolar diodes, power transistors (MOSFET, JFET, V-JFET), and RF components such as MESFET or SIT.

2. Components made in epitaxial GaN on SiC. Material used is 6H or 3C. Components are optoelectronic components such as blue LEDs, blue laser diodes or HEMTs.

3. MEMS. The high mechanical performance of SiC is used here for MEMS in harsh environments.

Figure 2 shows the segmentation of SiC material

	Power electronics					Optoelectronics		MEMS
	Schottky	Bipolar	MOSFET	MESFET, SIT	HEMT	LEDs	Lasers	
SiC 4H								
SiC 6H								
SiC 3C								
Poly SiC								

Figure 2: Segmentation of the different applications of SiC wafers

## High voltage components

The market for SiC components is high voltage and high frequency switching. The base components are fast rectifiers like Schottky or bipolar diodes and MOSFET, JFET or V-JFET transistors. A high volume market will be addressed once a fast switching cell integrating both a fast rectifier and a transistor is accomplished (today, the combined SiC rectifier (Schottky) and MOS transistor is used). Using SiC makes it possible to reach the frequency range and switching capacity not covered by Si components (Figure 3).

Switching capacity KVA

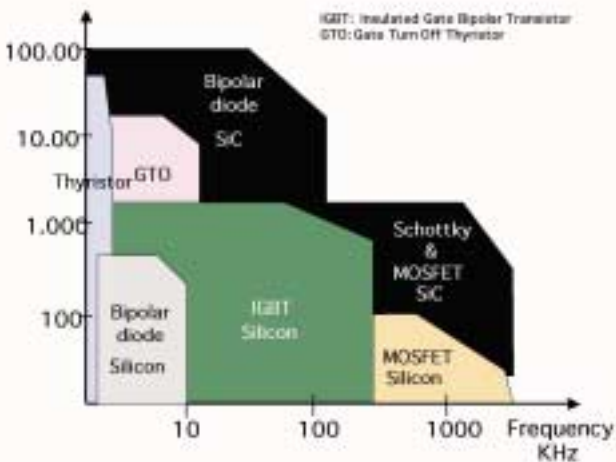


Figure 3: Switching capacity vs. frequency (source YOLE)

Today, the only plans for industrial production in the near future concern Schottky diodes. Main manufacturers are Cree (Microsemi), SiCed (Infineon), STM (Tours, France) and International Rectifier (Italy).

Bipolar diodes are still a challenge and are only at the R&D level today (players are Cree, SiCed and STM). The technological gap is the realization of thick p-doped SiC layers between 60 and 120 µm.

The MOS SiC transistor is currently under development. The technological gap is the low mobility of carriers at the SiC/SiO2 interface. A high volume market for power transistors could be the 48V in the automotive field.

## RF and Hyper components

Two types of components use SiC substrates:

- HEMT GaN/SiC
- MESFET SiC (Cree, Northrop Grumman; Thales, Acreo Kista)

The targeted market for these components is an emission base station for wireless phones (frequency range 0.9 to 2.2 GHz). Other applications could be TV emission stations or microwave ovens. Today, MESFET SiC technology is available and has the following performance: 100 W at 2 GHz. The competing technology is GaN/SiC (Figure 4).

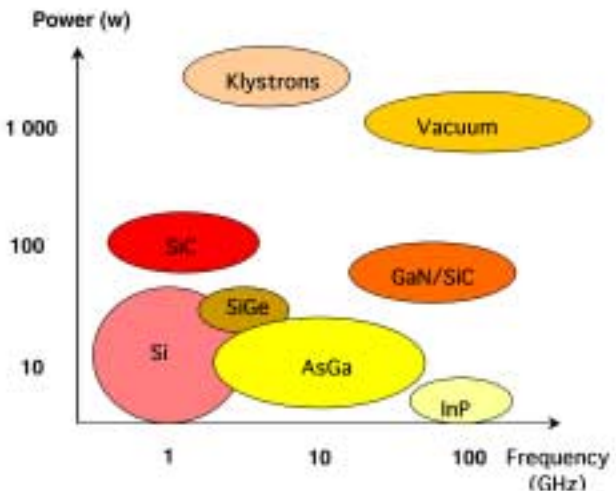
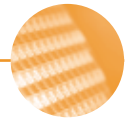


Figure 4: Power vs. frequency for different materials

## Optoelectronic components

Two types of components can be considered: blue LEDs and blue laser diodes, for three kinds of substrates: SiC, sapphire and Si. It is believed that sapphire could disappear shortly. SiC is dedicated to high performance applications such as lasers, and Si is a good candidate for low cost, low performance applications such as LEDs. The main market driver is, of course, the blue ray disc market which will require the use of blue laser diodes for the next generation of data storage (such as DVD). The overall market for SiC substrates for optoelectronics is about 100 000 units per year, which is more than 50% of the total annual production.

Yole is currently preparing a multi-customer study on SiC applications and market trends. If you are interested, please contact us at [eloy@yole.fr](mailto:eloy@yole.fr).



## SZ Testsysteme moved into administrative and production buildings

SZ Testsysteme has begun operations in its new administrative and production buildings at its headquarters in Amerang near Wasserburg, Germany. The German IC test supplier announced it would boost its production capacity to 250 testers annually in its new facility, expecting a possible turnover volume of some 150 million. The 9,500 m<sup>2</sup> production hall and the administrative building with 5,800 m<sup>2</sup> of office space are designed for a total of 450 employees

<http://www.sz.com>

## Alliances & Mergers

### IMEC and Mentor Graphics join forces in an R&D alliance

IMEC and Mentor graphics announced they had joined forces in an R&D alliance to pursue new resolution enhancement technology (RET) for sub-wavelength lithography used with 193- and 157-nm exposure tools.

IMEC will use the Calibre RET software under a 3-year agreement, in a collaborative effort to advance process capabilities in high-numerical aperture (NA) 193- and 157-nm lithography.

IMEC and Mentor Graphics had been informally collaborating since 1999.

IMEC and Mentor Graphics planned their research in double-exposure dipole decomposition resolution enhancement techniques which use less expensive binary masks, but still achieve enhanced resolutions similar to alternating, strong phase-shift masking and could be a candidate for sub-100-nm.

<http://www.imec.be> - <http://www.mentor.com>

### The 6-company joint-venture to start activities in June at the NEC research fab in Japan

The NEC SoC research fab in Sagamihara, Japan, was selected as the site for the new joint government-industry program 100-nm process pilot line, with a \$243 million total budget.

The joint venture includes 6 companies (Fujitsu, Hitachi, Matsushita Electric Industrial, Mitsubishi Electric, NEC and

Toshiba) and will be set up to help fund and operate the new 300mm wafer pilot line. The joint venture will be incorporated in June, said the Japan Electronics and Information Technology association which will help to coordinate the project.

<http://www.nec.com>

### New alliance in photomask production

After the announcement of the agreement between Infineon and Dupont Photomask, ST Microelectronics and Dai Nippon Printing (DNP) announced a partnership to build a photomask production facility next to ST's site in Agrate, near Milano, Italy. The agreement aimed at developing and supplying leading-edge and high-end photomasks, which are critical components in the manufacture of silicon integrated circuits. DNP will supply photomasks to ST for five years. In addition, DNP will develop the masks based on ST's manufacturing process road map, and ST will invest in DNP's new photomask fab in Italy, which will be DNP's first overseas.

Total investment will be \$150 million over 3 years. Construction starts in June and operation is expected to begin in June 2003. The new company name will be DNP Photomask Europe.

<http://www.st.com> - <http://www.dnp.co.jp>

### Virage Logic to License SRAM embedded memories to ST Microelectronics

Virage Logic announced an agreement to license its high density SRAM embedded memories, specifically high-density (HD)

Area Speed and Power (ASAP) SRAM and ROM embedded memories, on ST Microelectronics' 0.13-micron process. ST will use Virage Logic embedded memories in its chips for products aimed at telecom, computer, peripherals, digital consumer devices, automotive, communications and smart cards.

<http://www.st.com> - <http://www.viragelogic.com>

### ST plans its presence in Asia

In a plan to penetrate the Chinese market and to forecast strategic partnerships, ST Microelectronics' President, Pasquale Pistorio, detailed actions at the company's annual analyst meeting. Pasquale Pistorio announced ST Microelectronics would build a front-end facility by 2005 in China. ST also announced it would acquire competing semiconductor companies in Japan to increase its presence in Asia.

<http://www.st.com>

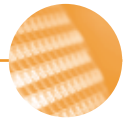
### Intel and UPC in R&D operations

At the Intel Developer Forum in Munich, Intel announced an agreement to conduct microprocessor R&D at the Universitat Politècnica de Catalunya (UPC) in Barcelona, Spain.

The UPC will operate a research center on behalf of Intel (Intel Labs Barcelona, ILB) on technologies for future Itanium (64-bit) and Pentium (32-bit) processor families.

Three professors from the UPC will lead the center: Antonio Gonzalez, Roger Espasa and Toni Juan.

<http://www.intel.com> - <http://www.upc.es>



## IMEC and Stars sign an agreement to develop new SoC design methodologies

IMEC in Leuven, Belgium, and Starc (Semiconductor Technology Academic Research Center) in Japan announced an agreement to collaborate on the development of advanced design methodologies for system-on-a-chip (SoC) applications using their respective technologies.

In a first phase, Starc will explore how to implement IMEC's OCAPI design methodology in its VCDS (Virtual Core-based Design System). OCAPI is a design methodology to develop platform-independent system models in C++.

In a second phase, IMEC and Starc will join forces to develop novel SoC design technologies on an equal partnership basis.

<http://www.imec.be> - <http://www.starc.or.jp>

## Philips, ARM, and Adelante to co-develop SoC platform

Philips of The Netherlands, ARM and Adelante Technologies announced that they had signed a memorandum of understanding to develop a common system-on-a-chip (SoC) platform for mobile applications. The SoC platform will allow derivative products to be produced quickly and reliably by tuning and adding system components that are either programmable or application-specific.

<http://www.philips.com> - <http://www.arm.com>  
<http://www.adelantetech.com>

## SEZ acquired L-Tech

Austria's SEZ Group acquired L-Tech for an undisclosed price. The company is based in Mountain View, Calif. L-Tech manufactures drying equipment for batch wafer processing. Its tools dry wafer substrates via isopropyl alcohol (IPA) technologies for the post wet cleaning process. SEZ continues on its quest to become a one-stop shop for wet bench tools in 200- and 300-mm fab applications.

<http://www.sez.com> - <http://www.ltechcorp.com>

## Construction activities started for AMTC

Construction of the equally owned joint venture of AMD, Infineon Technologies and Dupont Photomasks, started at the beginning of June in Dresden, Germany. The Advanced Mask Technology Center (AMTC) will develop and pilot manufacture advanced photomasks required for future generations of semiconductor products. At the same time, Dupont Photomasks will house a photomask production facility in the same complex as AMTC. Both projects are expected to be ready to install their equipment by the middle of 2003, with the first photomasks to be available later that year. Investment in the two projects is expected to reach Eur 500 million and to create 370 jobs.

<http://www.infineon.com> - <http://www.photomask.com>  
<http://www.amd.com>

## Infineon, Agere, Motorola create StarCore LLC

Infineon Technologies AG with Agere Systems Inc. and Motorola Inc. announced that they joined forces to establish a new and powerful DSP venture, StarCore LLC, with headquarters in Austin, Texas.

The venture is a new and independent company focused on developing and marketing digital signal processor DSPs. StarCore was an original venture between Agere and Motorola in 1998 before becoming StarCore LLC with Infineon.

The new company will attempt to compete against TI, the acknowledged leader in the DSP market.

StarCore LLC is expected to start operations in late summer 2002.

<http://www.infineon.com> - <http://www.agere.com>  
<http://www.motorola.com>

## Infineon and Micron to co-develop new class of pseudo SRAMs

Infineon and Micro announced the co-development of a new family of low-power pseudo SRAMs for wireless applications. It was the latest deal between the two companies, but Infineon and Micron are also co-developing a new class of DRAMs for communication products.

To develop SRAMs, a new technology is required dubbed CellularRAM. This is expected to make the CellularRAM memory a multi-source standard for the memory subsystems of next generation 2.5G and 3G handsets.

<http://www.infineon.com> - <http://www.micron.com>

## Infineon and Ericsson to become partners for wireless solutions

Infineon and Ericsson announced that they had entered a long-term strategic partnership. Infineon is to acquire Ericsson's microelectronics operation in Sweden for \$377 million in stock. Under the terms of the agreement, Infineon will assume control of Ericsson's microelectronics products, R&D, and certain manufacturing facilities. The acquisition allows Infineon to expand its business in Bluetooth solutions and radio frequency (RF) components for mobile phones. The transaction is expected to be closed during summer.

<http://www.infineon.com> - <http://www.ericsson.com>

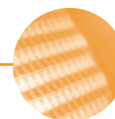
## Micronas will use UMC foundry services

Germany's Micronas, supplier of IC solutions for customers and automotive electronics, and UMC, a semiconductor foundry, announced a five-year agreement. Under the terms of the agreement, UMC will be the principal supplier of mixed-mode ICs for Micronas.

Micronas will also have access to UMC's advanced technologies and foundry capacities.

Micronas' DPS 9450 first pass silicon was successfully presented in April, and now has qualification at UMC. The first engineering lots of the MDE 9500, a single-chip hybrid analog/digital TV decoder, are to be processed soon. Both products use UMC's 180-nm (0.18 micron) mixed-mode CMOS technology.

<http://www.micronas.com> - <http://www.umc.com>



## Semiconductor sales increased 3.1% in April

Worldwide sales of semiconductors reached a 3.1% increase in April from \$10.73 billion to \$11.07 billion.

George Scalise, president of the SIA, announced "Semiconductor sales in April are continuing the steady growth exhibited in the first quarter of this year, another sign that the industry is rebounding from 2001; we expect the modest growth we are experiencing in the first half of the year to continue throughout the remainder of 2002."

He said that April's growth was led by an increase in sales in the wireless sector.

### April 2002 / Billions Month-to-Month Sales

Market	Last Month	Current Month	% Change
Americas	2.61	2.62	0.2%
Europe	0.26	2.28	1.1%
Japan	2.11	2.20	4.4%
Asia Pacific	3.76	3.97	5.7%
<b>Total</b>	<b>10.73</b>	<b>11.07</b>	<b>3.1%</b>

### Year-to-Year Sales

Market	Last Year	Current Month	% Change
Americas	3.76	2.62	-30.5%
Europe	3.08	2.28	-25.8%
Japan	3.36	2.20	-34.5%
Asia Pacific	3.54	3.97	12.1%
<b>Total</b>	<b>13.74</b>	<b>11.07</b>	<b>-19.4%</b>

<http://www.sia-online.org>

## Worldwide blank silicon wafer is expected to rebound after the downturn in 2001

After the Semi announcement (see Micronews #4) about silicon wafer substrate shipments in Q1 2002, Dataquest announced it would forecast a rebound in the worldwide silicon wafer market. In the year 2001, worldwide blank silicon wafer revenues reached \$5.4 billion, a 31% decline from \$7.8 billion in 2000.

According to Dataquest, the 300-mm wafer demand will increase moderately in 2002, and will ramp-up in 2003.

### Worldwide top 3 wafer suppliers according to Dataquest :

Rank	Company	Country	Sales in 2001	Market share
1	Shin-Etsu Handotai (SEH)	Japan	\$1.501 billion	27.9%
2	Wacker Siltronic AG	Germany	\$881 million	16.4%
3	Sumitomo Metal Industries	Japan	\$708 million	13.2%
4	MEMC Electronics Materials	USA	\$656 million	12.2%
5	Mitsubishi Materials Silicon	Japan	\$528 million	9.8%
	others		\$1.104 billion	20.5%
	<b>Total</b>		<b>\$5.378 billion</b>	

Source Dataquest June-2002

## FSA results on wafer demand

According to a survey from the Fabless Semiconductor Association (FSA), the worldwide wafer demand increased by 3% in the first quarter of 2002 compared to the fourth quarter of 2001. The results indicate the end of the semiconductor downturn and indicate that wafer demand will increase steadily in the remaining quarters of 2002.

In the survey, Fabless design houses and IDMs project that overall wafer demand will be 21% in the second quarter of 2002, 19% in the third quarter, and 17% in the fourth quarter.

But Fabless and IC makers disagreed about 2002 and 2003 forecasts. Fabless chip makers project that wafer demand will increase 54% and 55% in 2003 and

2004, whereas IDM believes that wafer demand will jump 35% and 29% in 2003 and 2004 respectively.

<http://www.fsa.org>

## Intel lowers its revenue forecast for Q2

Intel reduced its Q2 expectations from \$6.4-7.0bn to \$6.2-6.5bn. These results are due to lower than expected demand in Europe and a weaker than expected mix of microprocessor sales. Intel forecasted a stronger second half.

On the other hand, Europe's STMicroelectronics revenues are expected to increase 10% from the \$1.36bn of Q1.

<http://www.intel.com> - <http://www.st.com>

## Photoresist market is expected to grow 5-8% in 2002

According to Dataquest, the photoresist market for semiconductor production is expected to recover and grow by 5-8% in 2002 compared to 2001.

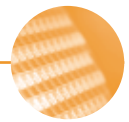
Material vendors are seeing an increase in their activities.

The worldwide semiconductor photoresist market reached \$663 million in 2001, a 23% decline from \$859 million in 2000.

### Top ranking in the photoresist market:

Country	Rank	Company	Country
Japan	1	Tokyo Ohka Kogyo	Japan
US	2	Shibley Co. L.L.C.	US
Japan	3	JSR Corp.	Japan
Japan	4	Shin-Etsu Chemical	Japan

Source: Dataquest - <http://www.dataquest.com>



## VLSI report gives signs of recovery

Signs, like capacity utilization and worldwide IC book-to-bill ratios show that the worldwide IC market is improving.

According to a report from VLSI Research, worldwide fab capacity utilization rates will hit 87% in June, up from 82.6% in May and 80% in April. Last December, capacity utilization rate hit bottom at 69%.

The worldwide IC book-to-bill ratio is expected to hit 1.44 for June, when bookings are forecast at \$13.5 billion and billings are at about \$10.8 billion, according to VLSI Research. An IC book-to-bill ratio of 1.33 and 1.18 was recorded in April and May respectively. These ratios are the highest ratios in the last 24 months.

<http://www.vlsiresearch.com>

## Equipment supplier and material supplier for Q1

	Q1	Q1	Q1 Y2001	Q1 Y2001
Company	Sales	%change Q-1	Sales	%change Y-1
Tepla	\$2.33 million	NA	\$26 million	-56%
IQE	\$8.29 million	-26%	\$18.8 million	-56%

Source: Yole Développement, June 2002

## Techno-News

### X-Fab launches XC035, its new 0.35-micron CMOS process technology

X-Fab Semiconductor Foundries announced the expansion of its silicon foundry portfolio with 0.35-micron CMOS process technology, XC035, for digital and mixed-signal applications.

This XC035 CMOS technology includes options for one or two poly layers and three or four metal layers; the technology is compatible with industry standards. The architecture of I/O structures allows their use in 3.3V applications, as well as in conventional 5V circuitry. Low-voltage and EEPROM are also available and will be supported in design kits in the near future. More analog elements will be gradually added to the new process family over the next 2 years.

<http://www.xfab.com>

### Ireland's Scientific Systems unveils online plasma fault detection tool

Ireland's Scientific Systems Ltd. introduced an online fault detection and classification version of its flagship ImPrint line of plasma process and control measurement tools. ImPrint detects faults in real-time and classifies them in chip making applications and also provides analysis on faults by measuring the plasma itself.

Applications for ImPrint include process chamber matching, process chamber qualification after preventive maintenance, process chamber fault classification, and process chamber fault diagnostics.

<http://www.scisys.com>

### Applied launches a wafer cleaning tool

Applied Materials launched a new tool called Oasis Clean for the wafer cleaning market. Oasis Clean is a standalone wafer cleaning system geared for 0.13-micron devices and below in 300-mm fabs.

Applied's tool is based on a proprietary "megasonic" particle-removing technology, and could be integrated into Applied's front-end wafer processing and metrology tools.

<http://www.appliedmaterials.com>

### TSMC demonstrated the "FinFET"

TSMC has demonstrated a new variation of the Field Effect Transistor (FET) called a FinFET, a working transistor with a 35-nm gate length.

TSMC researchers have already experimented with the FinFET, creating a gate length below 25-nm. They have also simulated the structure and claim it can operate within generally acceptable parameters at gate lengths as small as 9nm.

<http://www.tsmc.com>



## PHS MEMS introduces Accelerated MEMS prototyping services in US

PHS MEMS announced it launched an accelerated MEMS prototyping service worldwide for its customers, and specifically mentioned its new US office, located in Emeryville, California, that opened at the end of 2001.

The services validate the ability of MEMS devices to be manufactured (yield, cost and performance robustness).

Accelerated MEMS prototyping benefits are:

- Early validation of process flow and device specifications to accelerate time to produce
- Early design variation analysis through

extensive device modeling (RF, Optic & Magnetic) and FEM simulation

- Early estimation of manufacturing cost for Return on Investment assessment
- Evaluation of capacity requirements for volume production, Packaging, Assembly & Test
- One single partner from design to volume production

Choosing the Silicon Valley to introduce accelerated MEMS prototyping should enhance PHS MEMS' development and production capabilities.

<http://www.phsmems.com>

## Alcatel Optronics Netherlands in MEMS activity

Alcatel Optronics in Paris, France, announced an industrial redeployment plan which will affect all its manufacturing locations. Alcatel Optronics in the Netherlands intends to dispose of its MEMS and planar design software activities through buy outs that are expected to close at the end of June 2002.

The MEMS business in the Netherlands is non-telecom and not considered as core to Alcatel Optronics.

The planar design team will be exclusive to Alcatel Optronics for a minimum of one year.

<http://www.alcatel.com>

## Alliance & Mergers

### Tronic's and the CEA Leti announced a MEMS R&D agreement

The French MEMS foundry Tronic's Microsystems and the French Laboratory CEA Leti have just signed a 3-year R&D contract to ensure the evolution of new devices of the manufacturing technologies of SOI based MEMS which were transferred by the CEA Leti to Tronic's.

This alliance allows Tronic's to maintain its competitive edge in the fabrication of MEMS on SOI wafers for high-end applications.

<http://www.tronics-mst.com>

### Jazz and MEMSCAP in a joint manufacturing and marketing agreement

Jazz Semiconductor, an independent high performance mixed-signal and radio frequency (RF) silicon wafer foundry

spin-off of Conexant Systems, announced a joint manufacturing and marketing agreement with France's MEMSCAP, a supplier of microelectronics mechanical systems (MEMS).

The agreement will enable Jazz Semiconductor to provide silicon-germanium (SiGe) BiCMOS processes and integrated radio-frequency (RF) MEMS solutions under the foundry agreement.

<http://www.memscap.com> - <http://www.conexant.com>

### EQT Northern Europe acquire all VTI's shares

Following an agreement signed on 24 May 2002, the private equity fund EQT Northern Europe will acquire all the shares and business of VTI Hamlin Oy, a global leader in the development and manufacture of motion measurement sensors.

The arrangement supports VTI's business goals and its renewed strategy also to extend its services to other industries outside the automotive field.

Under the transaction, the American company BREED Technologies, Inc. will sell the entire share capital and business of VTI Hamlin to EQT. The transaction will be closed at the end of June subject to regulatory approval. In connection

with the arrangement VTI Hamlin Oy will change its name to VTI Technologies Oy as of 1 July 2002.

<http://www.vti.fi> - <http://www.eqt.de>

### French water nanofiltered

With the tightening quality standards imposed by the European Union, Générale des Eaux, a unit of conglomerate Vivendi Universal, developed in its own laboratories the nanofiltration technology in collaboration with Dow Chemical subsidiary Filmtec.

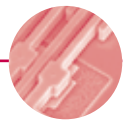
After efforts to get microfiltration products smaller and smaller, as pumps which press the water into a microfiltration membrane with openings measuring around 5 microns in diameter.

The water is pushed through polymer membranes whose holes measures 1 nanometers each.

Générale des Eaux has also been selling its technology to others like an Israeli company for nanofiltration plant adapted for seawater.

<http://www.generale-des-eaux.com> - <http://www.filmtec.com>

<http://www.dow.com>



## A plan to jointly develop an international group specialising in design-for-test

The Institute for System Level Integration (Livingston, Scotland) and Lancaster University's Centre for Microsystems Engineering announced that they plan to jointly develop an international group specialising in design-for-test and reliability engineering for SoC and MEMS. The group will concentrate on research programmes, teaching, training activities and consultancy projects, with the objective of assisting industry to address the problems of manufacturing costs and quality of highly integrated, miniaturised electronic systems.

The partnership's first activities include two EU-funded research programmes under the IST Framework V program, TAMES-2 and MACROS, a jointly managed postgraduate studentship and the development of a distance learning course in Design for Testability.

## Co-operation between SensoNor MEMS Foundry and Saab MicroTech

Norway's Sensoror and Sweden's Saab Microtech announced their agreement to co-operate on developing and manufacturing in the field of microtechnology.

Under the terms of the agreement, Saab MicroTech will design, construct and develop devices and systems, Sensoror will manufacture the micro-devices.

Thanks to this co-operation, and by designing and developing directly in a production-adapted process, the risk in transferring prototype design to manufacturing is minimized or eliminated.

<http://www.sensoror.no> - <http://www.saabmicrotech.se>

## European Program to create MEMS vacuum cavities

European "Fifth Framework Programme" has been set up to develop wafer-to-wafer bonding techniques for long-term vacuum encapsulation. The aim is to create micro-electro-mechanical system (MEMS) vacuum cavities.

The leader of the work will be STMicroelectronics' MEMS Development unit at Agrate, Italy. Other contributors will be Saes Getters, Thales Avionics, EV Group E Thallner, Pavia University, and Fraunhofer Institute for Silicon Technology (ISIT).

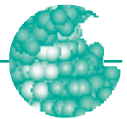
The vacuum wafer bonding will be optimised using eutectic bonding in combination with getter materials in the cavity. A hermetic feed-through will also be developed for vertical electrical vias through the cap wafer.

The project applications will be to RF switch and high frequency resonators for telecoms and consumer use. Also a pressure sensor for high-reliability avionics and industrial applications will be produced.

<http://www.st.com>

## Bio & Microfluidic Chips

### Life & Death



## Debiotech expands its R&D facilities in Lausanne

Thanks to an important growth of its activity over the last 12 months, Debiotech announced the acquisition of a new surface, 550 m<sup>2</sup>, at its present location. This expansion will be dedicated to new offices and clean rooms for the development of MEMS devices. It represents an increase of 50% in term of R&D capabilities. The opening is scheduled for September 2002.

<http://www.debiotech.com>

## Alliance & Mergers

### Exclusive collaboration between Axon Instruments and Aviva Biosciences

The two companies signed an agreement to collaborate on developing and marketing a Patch-on-a-Chip™ planar electrode device for use in Axon's PatchXpress ion channel drug screening systems. The agreement gives Axon exclusive marketing rights to Aviva's patch-clamp biochip.

<http://www.axon.com> - <http://www.avivabio.com>

### Joint development and marketing agreement for Tecan and Luminex

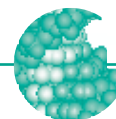
Tecan and Luminex agree to integrate Tecan's sample preparation and handling instrumentation with Luminex's xMAP™ technology. It is a strategic alliance to couple Luminex's proprietary xMAP technology with Tecan's line of automation products. The two companies agreed to co-market the resulting systems.

<http://www.tecan.com> - <http://www.luminexcorp.com>

### Genotyping services agreement for Illumina

Illumina signed a commercial agreement with the UNC Pulmonary and Cystic Fibrosis Research Center to provide single nucleotide polymorphism (SNP) genotyping services on a sample collection provided by the Center. Illumina will design functional assays and use its BeadArray technology to genotype specified SNPs in the sample set.

<http://www.illumina.com>



## Gyros and Kratos Analytical start their collaboration

The two companies will develop a micro-laboratory for sample preparation prior to analysis by mass spectrometry to be based on the Gyros microfluidic technology platform. The system will be compatible with the line of mass spectrometry workstations from Kratos. Kratos Analytical is a subsidiary of the Shimadzu Corporation of Kyoto, Japan.

<http://www.gyros.com> - <http://www.shimadzu-biotech.net>

## Research collaboration between Sequenom and Samsung

Sequenom and Samsung Advanced Institute of Technology (SAIT), Korea announced a joint research agreement. The collaboration will include genome-wide screens to identify potential disease-related markets. SAIT plans to use the markers to develop their biochips. SAIT has already installed multiple MassARRAY™ systems, Sequenom's high performance genotyping platform. Sequenom and SAIT will share commercial rights to disease gene discoveries and other intellectual property generated by the research collaboration.

<http://www.sequenom.com> - <http://www.sait.samsung.co.kr>

## Microtechnology development agreement for Central Research Laboratory

Central Research Laboratory Ltd (CRL), and Sophion Bioscience A/S in Copenhagen have entered a R&D contract to jointly design a new pharmaceutical research product for advanced screening of ion channel drug targets. The two year agreement will cost 2.6 million and will allow CRL to provide innovative solutions to assist Sophion in their objectives to develop and launch chip-based medium and high throughput electrophysiology systems. The strategic alliance between CRL and Sophion will create commercial benefits for both parties that neither could achieve alone.

<http://www.crl.co.uk> - <http://www.sophion.dk>

## Motorola and BioDiscovery signed a supply agreement

The Life Sciences business unit of Motorola announced an OEM supply agreement with BioDiscovery Inc. This contract concerns the distribution of ImaGene plus the Automation Module software package as part of Motorola's CodeLink™ Bioarray system. Terms of the agreement were not disclosed.

<http://www.motorola.com> - <http://www.biodiscovery.com>

## Prolinx signed distribution agreement with Daiichi

This collaboration concerns Prolinx' Versalinx™ Chemical Affinity Tool bioresearch product line. Daiichi Pure Chemicals Co. Ltd of ChuoKu, Tokyo, Japan, provides advanced research reagents and systems for life science research to the Japanese market and will represent the entire range of Versalinx products. Daiichi plans to start marketing Versalinx products in June 2002.

<http://www.prolinx.com> - <http://www.shiyaku-daiichi.jp>

## Qiagen and Affymetrix signed a supply agreement for Nucleic Acid Purification Solutions for GeneChip® Arrays

The new contract between the two companies follows their previous research collaboration. This research led to optimizing certain nucleic acid purification technologies from Qiagen for use with Affymetrix' GeneChip expression arrays. Under the supply agreement, Qiagen will manufacture products customized for use with Affymetrix' GeneChip expression analysis. The products will be distributed by Affymetrix for use on the GeneChip systems. Financial terms were not disclosed.

<http://www.qiagen.com>

## New products

### Three Japanese partners for a new DNA chip

Asahi Techno Glass Corp., NovusGene Inc. and Olympus Promarketing Inc. co-developed DNA chips which sport an array of mouse genes that can be used for new drug development. The companies make their DNA chips using a proprietary technology owned by Novusgene that places shorter DNA fragments on the chip. These probes stick better to the chip raising the detection precision of the device.

The three partners announced that they will soon start marketing their innovation. The new chip will be sold in sets of four, priced at a relatively inexpensive US\$ 787.95 per set. In addition, NovusGene, which is a subsidiary of Olympus Optical Co., as well as Olympus Promarketing, will use them for a contract gene analysis service.

<http://www.novusgene.co.jp> - <http://www.olympus-pm.co.jp>



## A New French start up

Digital & Lightwave Technology, a new French start-up, is actually a spin-off of the optical interconnection activities of Thales Research and Technology. For more than 7 years, Thales has developed optical-fiber-based modules for high-speed data transport based on silicon micro technologies. The team of 5 people has developed high speed parallel optical interconnection modules (D-Light family) and transceiver modules (S-Light family), and will develop new modules based on free space communication (F-Light family). With this offer, these modules can cover all the optical interconnection modules market.

Digital & Lightwave Technology plan to launch its activities in September and market its first products within less than one year.

## Alcatel Optronics reduces its work force

Alcatel Optronics announced that, as a consequence of difficult market conditions, it planned to cut a quarter of its 1,805 employees by the end of 2002, reducing the level to about 1,350 (25% reduction). The announcement said the latest cut backs would affect France (Illkrich and Lannion sites), Canada (Fiber Bragg in Gatineau activities transferred to Livingstone in Scotland), the United States (Plano, Texas), the Netherlands and Scotland. Taking into consideration the 800 job cuts made during 2001, this would cut Optronics' overall fixed cost levels by about 30%.

<http://www.alcatel.com/telecom/optronics>

## The UK JDS Uniphase site, SDL has closed

Just one year after the acquisition of SDL Integrated Optics by JDS Uniphase (March 2001), the manufacturing facility has closed. It is a 700 m<sup>2</sup> plant for wafer manufacture and packaging with a class 100/1000 clean room. This JDS site focused on the optical telecommunication market with 2.5 Gb/s and 10 Gb/s products. The technology was based on lithium niobate.

## Corvis-Algety to plan organization change

Corvis-Algety, S.A., a French subsidiary of Corvis, met with the local workers' committee to discuss a plan to organize its French subsidiaries. Corvis-Algety proposed to develop a plan along with the local workers' committee that would involve work force reductions. The company believes it must take these steps to continue to provide the best service to

its customers, to adjust to the pressures from the weak market, and to protect the long-term interests of Corvis Group employees. Corvis-Algety is also working with government authorities to ensure complete compliance with all labor laws. The company believes that the reductions could involve approximately 170 jobs.

<http://www.algety.com>

## First shareholders meeting in the new facilities for Memscap

MEMSCAP announced the relocation of its registered French headquarters and all Grenoble-area facilities, to its new production site located in Bernin, outside of Grenoble. The management and design teams moved to the new offices, joining the production staff who had been on site since December. The company now operates in 13,520 square meters of space. MEMSCAP had chosen the technological hub of Bernin to build its manufacturing facility and consolidate teams previously distributed over several regional sites. It was also the opportunity for investors attending the annual shareholder meeting to have a preview visit of the building and clean rooms. The official inauguration of the site will be held at a later date.

<http://www.memscap.com>

## Alliance & Mergers

### Merger of the companies Ionas A/S and Cisilias A/S

NKT Holding AS of Copenhagen, a Danish electronics conglomerate, announced that it had decided to merge its units Ionas and Cisilias (retro-dating the merger to January 1, 2002).

The new 69-person group would be called NKT Integration and would service the global telecommunications sector with both foundry services and active and passive optical components.

NKT Holding's products include white goods, and it has a photonics set of companies including NKT Research, IONAS (glass wave-guides), Crystal Fibre (developer of new crystal fiber products), CISILIAS (optical amplifiers), KOHERAS (combines CISILIAS' technology with fiber technology to produce a light generator inside the fiber) and LIOS Technology (fire warning systems based on optical fibers). The merger decision is based on NKT's wish to consolidate its future position as an important industrial player in the optical part of the telecommunications sector and on the assessment that PECVD (Plasma Enhanced Chemical Vapour Deposition) technology will, from a qualitative point of view, be the leading manufacturing technology for optical chips and integrated optical components. IONAS is one of very few producers worldwide using PECVD technology on a commercial scale.

<http://www.ionas.dk> - <http://www.cisilias.com> - <http://www.nkt.dk/uk/nkt/integration.php4>



## Eblana Photonics Funding Reaches 3.6 million Euros

Eblana Photonics (provider of advanced laser communication products), has announced new funding that brings its total investment to EUR 3.6 million in just over one year. Eblana Photonics is a spin off from Trinity College Dublin, the Irish National Microelectronics Research Centre and Enterprise Ireland, who are shareholders in the company. Other investments in the company include a combination of Irish and US private equity sources. The new funding is being provided by ACT Venture Capital and Enterprise Ireland. For the first time, Eblana's proprietary technologies allow high performance laser components to be economically manufactured for mass market communications. The company utilizes an outsourced manufacturing model using volume scaleable processes already proven in the wider microelectronics industry.

<http://www.eblanaphotonics.com>

## Heptagon has chosen UK distributor

Heptagon of Finland has appointed Ivo Associates as its UK distributor. According to Heptagon's CEO they are proud to have Ivo as their distributor in one of their key markets. They want to serve their UK and Eire customers with the best that is currently available in micro-optics.

<http://www.heptagon.fi>

## News Products

### Eblana aligns pump lasers in metro and access

Eblana Photonics (provider of source and pump lasers for emerging metro and access optical applications) has opted to outsource its manufacturing. The aim is clear: to add value during the product design and development cycle. The traditional method for manufacturing high-performance laser diodes is via a complex series of growth, regrowth and etching phases. Eblana is pioneering an approach known as photon mode engineering to impose device characteristics. The technique involves etching geometrically precise microstructures into the semiconductor wafers used to manufacture the lasers (with the etching taking place following initial growth of the laser's epitaxial layers). The microstructures "pattern" the refractive index seen by an optical field propagating through the device, which in turn creates a band structure that can be manipulated to control the allowable optical modes in the laser. Eblana is concentrating its efforts on two key components: a 980 nm pump laser (200 mW output power) for mini-amplifier applications, and a source laser with ultrahigh spectral purity (offering a minimum output power of 4 mW at data rates up to 2.5 Gbit/s). Both devices are now sampling.

<http://www.eblanaphotonics.com>

### Teem begins commercial shipment of Metro EDWA™ series

Teem Photonics announced that it began shipping its Metro EDWA optical amplifier series to a number of major OEMs in Europe and the US. The demand for the Metro EDWA series lies in its ability to offer buyers a choice of performance at considerable reductions in cost and size. Planar integration underlies Teem's proprietary low-cost ion-exchange process that is used to manufacture the Metro EDWA (erbium doped waveguide amplifier) series. Metro EDWAs are full function gain modules with uncooled pumps and electronic options in an 81 x 35 x 12 mm 16 pin "industry standard" form factor package. Three C-band versions are available for Metro applications. Metro EDWA-SC (single channel booster or pre-amp for metro applications), Metro EDWA-NB (to amplify adjacent 4-8 channels in metro DWDM networks) and Metro EDWA-DWDM (a >15 dBm unit aimed at amplifying multiple channels in a metro ring or spans).

<http://www.teemphotonics.com>



*Metro EDWA SC, NB, DWDM*



## Ibsen Photonics' DWDM power monitor reduces operational costs

The Danish component maker, Ibsen Photonics, has developed a monitor for real-time measurement of channel power in dense wavelength-division multiplexing (DWDM) systems. The D-MON uses a diffraction grating to split incoming signals onto a custom diode array, simultaneously measuring the individual intensities of up to 80 optical channels at 50 GHz spacing. The D-MON Channel Power Monitor aims at reducing operational costs in DWDM networks by saving space, lowering power consumption and lowering installation and maintenance costs of DWDM networks. The power monitor is based on Ibsen's Diffractor platform, a patent-pending optical design that enables parallel processing of individual channels. The company manufactures the diffraction gratings in-house using a holographic manufacturing technique.

<http://www.ibsen.dk>

## Austriamicrosystems introduces new ASIC library for PON

Austriamicrosystems unveiled its new generation of electro-optical interface ICs for passive optical networks (PON). The system's high bandwidth is designed to support teleworking, video distribution and high speed data sharing. The KEOPE (Key Electro-Optical Elements) chipset was implemented on Austriamicrosystems' silicon-germanium manufacturing process.

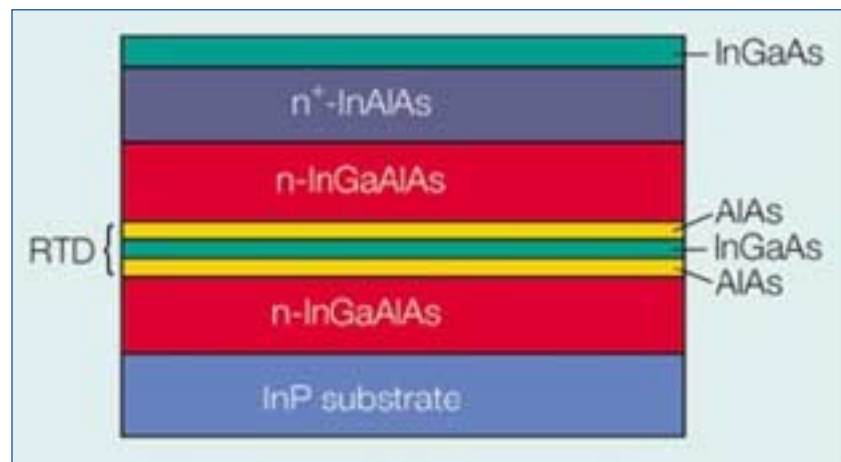
<http://www.austriamicrosystems.com>

## Essient Photonics brings new thinking to optical modulation technology

Essient Photonics, a spin-off from Glasgow University in Scotland and specialised in optical modulators and photodetectors, develops devices which take advantage of the properties of resonant tunneling diodes (RTDs). Essient's novel RTD-based technology for making 10 and 40 Gbit/s optical modulators and photodetectors will significantly lower the drive voltage and footprints compared to current devices. Essient announced that its modulators could operate with a drive of 0.1 V, significantly lower than the several volts needed for lithium niobate and InP- or GaAs-based devices. The company is headquartered in Glasgow and is following a fabless business model. Essient uses Compound Semiconductor Technologies in Glasgow to manufacture the devices currently in the development phase.

RTDs use a quantum well between two thin barrier layers to create an electron resonator. The patented Essient technology describes an RTD structure as consisting of a 6 nm InGaAs QW between two 2 nm AlAs barrier layers. The RTD is sandwiched between two InGaAlAs spacers that form the waveguide core. The InP substrate and a top InAlAs layer provide waveguide cladding, and an InGaAs contact layer is grown on the top cladding layer. Ridge waveguides are then etched and ohmic contacts deposited.

<http://www.essient.com>



*The Essient RTD structure*

## Pirelli Sirocco® blown fiber solution for low cost customer connections

Pirelli Telecom Cables & Systems has introduced a 12-fiber single-mode module that extends the range of Sirocco blown fiber products used to achieve low cost network start-up, flexibility for network growth and re-routing. The Sirocco 12-fiber module provides an important addition to the range of options for network operators and IT managers assessing the most practical and cost effective solutions to their network building strategy. The standard design is a 3-layer UV-cured acrylate matrix, with an inner low modulus layer to prevent micro-bending, a high modulus layer for protection, and finally a low friction coating containing microspheres to optimize blowing performance. These designs are manufactured exclusively by Pirelli under license from BT Group plc.

<http://www.pirelli.com>

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