imec newsletter

IMEC, Kapeldreef 75, B-3001 Leuven, Belgium no 24 - July 1999

Semicon West, booth # 4306, July 12-14, San Francisco, USA

36^{th} Design Automation Conference, booth # 119, June 21-25, New Orleans, USA

Founder and president of IMEC deceased

On April 29, 1999, Professor Roger Baron Van Overstraeten, president and chief executive officer of IMEC passed away at the age of 62. His decease will be a great loss for IMEC, the Flanders region and the microelectronics community. In the past 15 years, he guided IMEC to become the largest independent microelectronics R&D center in Europe, with many industrial initiatives spun off it.

Roger Joseph Van Overstraeten was born on December 7, 1937 in Vlezenbeek, Belgium. He received his engineering degree in electronics and mechanics from the University of Leuven (K.U.Leuven, Belgium) in 1960. In the same year, he went to Stanford University to obtain his PhD degree in physical electronics in 1963 under the supervision of Professor John L. Moll. His PhD thesis work was concentrated on the high-voltage breakdown effects in silicon diodes. Two years later, he was appointed as associate professor at K.U.Leuven and became full professor in 1968.

He soon realized what enormous impact IC technology could have on the electronics industry and the need for concentrated R&D in IC design and production in Flanders. In 1969, he started a laboratory with clean room facilities for integrated circuits at the Department of Electrical Engineering of the K.U.Leuven. Under his leadership, pioneering work was performed by Gilbert Declerck, Robert Mertens, Walter Fluit, and Hugo De Man, now senior advisers or members of IMEC's management committee. Many historical designs were carried out by the lab, such as the design of a chip set for the first remote control for a TV set and one of the first solid-state switches for Bell Telephone. Professor Van Overstraeten realized the need for computer aided chip design to efficiently design tomorrow's ICs and established a new research

continued p.2

In this issue...

Founder and President of IMEC deceased	1-2
High quality InGaAs/AlGaAs lasers	1
CMOS processing	3
Deep submicron lay-out service	4
Small-molecule OLEDs	4
UMC and Virtual Silicon Technology	5
MTC - Microelectronics Training Center	6
Training programs at IMEC	7
Courses	8
Events	9
Awards	9
Professor Declerck: new president	10
ARRM 99	10
Patents	11
Request for more information	12

Technology report

High-quality InGaAs/AlGaAs lasers grown on Ge substrates

In collaboration with Union Minière (Belgium), IMEC's associated laboratory INTEC (University of Gent), successfully demonstrated the feasibility of germanium substrates for electro-optic devices, normally grown on GaAs wafers. Ge offers the advantage of lower cost, higher strength and the potential of larger diameters compared to GaAs substrates.

Although not commonly kown, a significant share of the worldwide commercial MOVPE (metal organic vapor phase epitaxy) growth is performed on Ge substrates, mainly for GaAs/Ge solar cells applications. Compared to GaAs wafers, Ge offers some important advantages: Ge substrates are available for roughly half the price of 4-inch GaAs wafers, the strength of the germanium allows the substrates

continued p.3

continued from p.1

team with Herman Beke (now general manager of Frontier Design), Hugo De Man (professor K.U.Leuven and senior fellow IMEC) and Willy Sansen (professor K.U.Leuven). In 1981, this resulted in California-based SilvarLisco, one of the first CAD companies selling state-of-the-art layout tools on the world market.

Visit of Belgian King Boudewijn.

In 1976, the laboratory was transformed into ESAT (Electronics, Systems, Automation and Technology) at K.U.Leuven which Professor Van Overstraeten directed till 1984.

In 1984, the local government of Flanders, Belgium, decided to actively support microelectronics as one of the key industries for the future. Out of this, IMEC was born, a microelectronics R&D center based in Leuven, Belgium, headed by Professor Van Overstraeten. Under his guidance, IMEC developed itself at the heart of Europe to become the largest independent microelectronics R&D center in this region, with a global buget of over $80 million in 1999 and a staff of over 820.
In the past 15 years, his visionary look to microelectronics and the future of the information society led IMEC to its world-famous reputation of today. He recognized the need for worldwide globalization of R&D cooperation: "R&D should be viewed on a world scale. I think there is no other way. Production globalizes, and so does R&D", he stated in *Newsletter 22 (July 1998)*.

This topclass microelectronics research has resulted in a large number of industrial initiatives. Professor Van Overstraeten has always strongly encouraged entrepreneurship. Many of his former students have started new commercial activities, and are now managing Flemish and foreign companies. No less than 15 spin-off companies were created under his leadership, ranging from IC process technology to microsystems, chip design and telecommunications. One of them, CoWare, is headquartered in Santa Clara, Silicon Valley, and has offices in Belgium, United Kingdom, USA and Japan.

He felt that starting new industrial activities can only be successful if a number of critical factors are available: R&D, networking, entrepreneurship, training, infrastructure and venture capital. As an example, he initiated "IT-Partners", a $70 million venture capital fund that invests in companies which are active in the field of information technology, preferentially in those companies which might acquire a leadership position in their business sector.

Professor Van Overstraeten always recognized the growing importance of human capital and the increasing need for dedicated training. He played a crucial role in setting up new training activities as he understood that the need for well-trained people would soon become a key issue for the future of the electronics industry: INVOMEC, with many training courses in EDA, a postgraduate course in telecommunications, in close cooperation with universities and industry, and video conferenced all over Europe, and recently, the establishment of a Microelectronics Training Center, for dedicated industrial training of process operators, technicians and engineers of the electronics industry.
The evolution of "his" IMEC into what it is today has increased impact in the European Union. "Local initiatives that grow into large R&D centers such as IMEC are greatly appreciated by the EU as they provide a means of European cooperation rather than competition," he stated recently. "They allow for R&D in fields that need enormous investments and a pool of high-tech professionals."

Professor Van Overstraeten was awarded many times for his numerous achievements in microelectronics and initiatives in Flanders. He was a member of the Royal Academy of Sciences in Belgium and a fellow of the IEEE. In 1990, he was elevated to the nobility by King Boudewijn as Roger Baron Van Overstraeten.

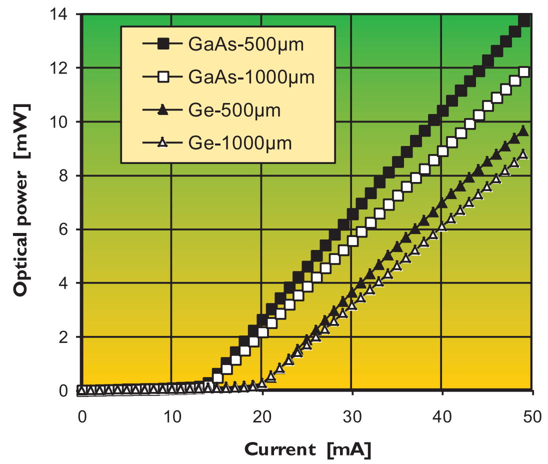
November last year, Professor Gilbert Declerck was appointed as chief operating officer at IMEC. Since then, Professor Van Overstraeten focused his activities on the overall IMEC strategy and external initiatives such as the creation of spin-off companies.

His memory will live on forever in IMEC.

In memory of Professor Van Overstraeten's wish to encourage young scientists to face the challenges of microelectronics, it has been decided to create a foundation "Stichting Roger Van Overstraeten". Donations can be made to the foundation's bank account no. 230-0019661-87.

continued from p.1

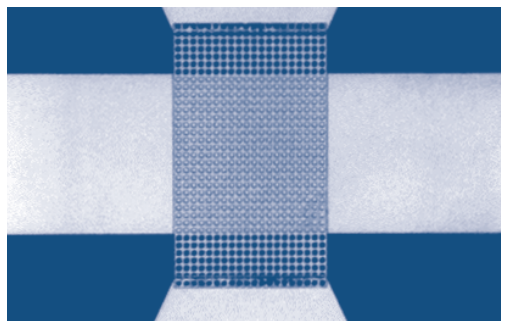
to be made thinner, of importance for weight sensitive applications, and larger diameter (currently up to 6-inch) wafers can be obtained. Growing GaAs on Ge poses a number of challenges. The most significant problem is the difference in lattice structure, influencing the electrical properties of the material. The difference in lattice constant can lead to degraded material quality in case misfit dislocations are formed, resulting in worse electrical and optical performance of the device. To overcome these problems, an adequate buffer layer was grown on the Ge wafer.
Laser diode structures were grown on both Ge and GaAs in the same run. The active region consisted of a single 6-nm $In_{0.17}Ga_{0.83}As$ quantum well embedded in an undoped GRINSCH confinement structure, grading stepwise from 15% to 35% aluminum. Laser operation (at 980 nm) was readily obtained, without any special techniques such as thermal cycling or selective growth on small areas, or epitaxial overgrowth. Threshold currents were a little higher than similar devices on GaAs substrates, and quantum efficiency was comparable. These results indicate that germanium is indeed a good candidate to replace the more expensive GaAs substrates. To our knowledge, this is the first time that laser operation was demonstrated on germanium substrates (at room temperature, CW).
For the 500-µm cavity devices 28% quantum efficiency was obtained per (uncoated) facet (compared to 30% on a GaAs substrate), and the 1000-µm cavity devices exhibited a TO-value of 165K.
Output powers of 130 mW (at 500 mA) per (uncoated) facet were demonstrated for broad area lasers, fabricated from the same single QW layerstack.



Comparison between 5 micron stripe lasers grown on GaAs and Ge substrates for 500 and 1000-micron cavity length.

CMOS processing as a basis for microsystems technology

IMEC offers its know-how and expertise in the area of microsystems technology and submicron CMOS process development for R&D projects in the field of new microystems applications and fabrication technologies.



Detail of a micromachined relay for switching RF signal paths.

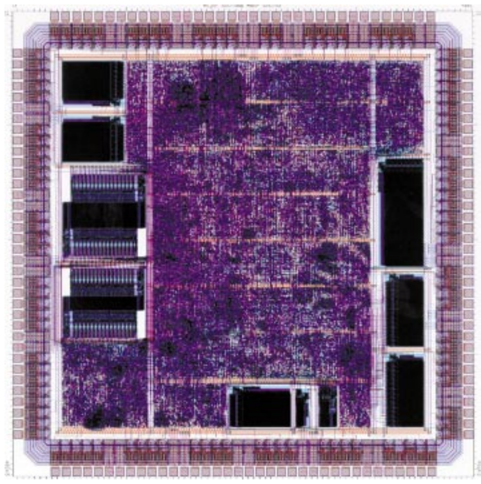
The baseline is formed by standard CMOS process modules and full processes complemented with specific modules to realize the required sensor and actuator functions. The R&D work in this field is executed in very close collaboration with the user of the microsystems technology component and the foundry to which the process will be transferred for mass production. Whenever possible, existing process modules of that foundry will be used. This results in a maximum guarantee for manufacturability.
Applications under development are CMOS image sensors, micromachined RF components, microswitches, IR detector arrays, chemical sensors, inkjet printheads, magnetic sensors, LEDs and biosensors.

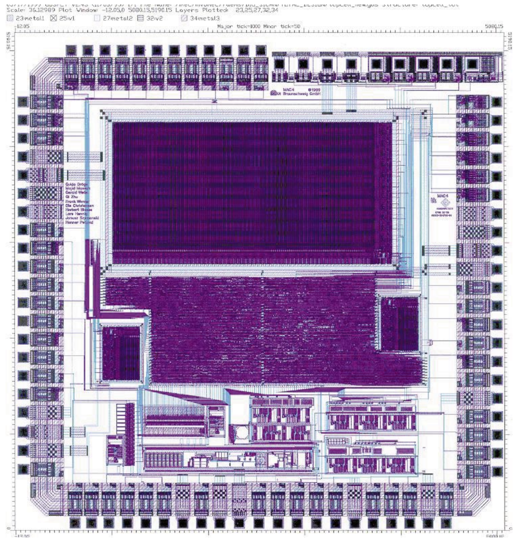
For more information, please contact:
Lou Hermans
Lou.Hermans@imec.be
tel. + 32 16 28 14 63

Industry link

Deep submicron layout service

Deep submicron layout generation is a difficult task. Lots of things are to be considered and can cause serious problems for circuits: clock-skew, latency of interacting clocks, IR-drop on power-distribution, electro-migration problems, delays caused by the interconnect, handling 5 or more layers of metal in the back-end.
IMEC offers a deep submicron layout service, starting from gate-level netlist. The service includes clock-tree synthesis, and provides information allowing circuit designers to verify post-layout timing using timing simulation or static-timing analysis. All information is provided to automatically update the circuit in an incremental way, using in-place optimization in the synthesis tool. This can involve buffer insertion, cell replacement, and local re-synthesis. The differences will be updated in the existing layout using ECO-placement (engineering change order). ECO iterations typically are done within 24 hours, providing complete feedback to redo all verifications.
Several circuits have been taped out, for 3 and 5 metal-layer processes, both for systems-on-a-chip developed at IMEC as for ASICs developed by third party design houses, research institutes and universities. Several of the circuits have been systems with analog blocks, combined with other macros and memories.
Circuit complexities handled were up to several hundred thousands of equivalent gates, system clock-rates up to 200 MHz.
Typically, layout and full verification is done in 10-15 working days.





For more information on this service, please contact:
Bart Demey,
Bart.DeMey@imec.be
tel.: +32 16 28 12 49

Technology report

Small-molecule organic light emitting diodes (OLEDs) realized using spin-coating

Organic materials, commonly referred to as "plastics", have many unique properties: they are mechanically flexible ("plastic"), light-weight and low cost. Some plastic materials are light-emitting semiconductors and as a result of that, it is today expected that organic light emitting diodes will soon be introduced in many consumer display applications. Applications envisaged are large, flexible, inexpensive light-emitting plastic screens in lightweight backlights for computer displays, flat plastic television screens, wall decorations, watches, cellular phones, toys, etc.

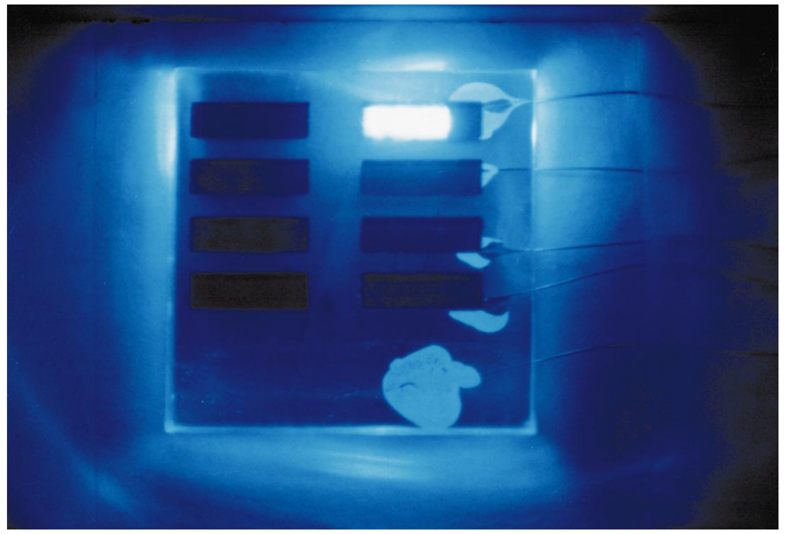
One way of fabricating OLEDs is to use a polymer as organic layer, using spin-coating. The other is to use an organic film made of small molecules (for example 3 to 6 monomers of organic material), and this is normally achieved by evaporation of these small molecules in a vacuum system. Both methods have their advantages and disadvantages: polymers are more difficult to synthesize and purify than small molecules; on the other hand, spin-coating is potentially a cheaper fabrication method than evaporation. At IMEC we have investigated the fabrication of small molecule OLEDs by spin-coating. This is done by blending the small molecules in an inert matrix polymer, and spin-coating this blend.
A first example is a blue-emitting OLED based on an oligomer synthesized at the University of Antwerpen. The spectrum shows peaks at 450 nm and 480 nm. The external quantum efficiency is 0.25 %. The luminous output is 37 cd/m² at a current of 0.23 mA.

In addition orange single-layer, high-efficiency OLEDs were fabricated using a host-guest small-molecule system. The OLED emits a spectrum with an emission peak at 555 nm, has an external quantum efficiency of 2.0% and a maximum brightness of around 4000 cd/m² respectively. The luminescence is as bright as a fluorescent lamp.

Finally, white OLEDs were demonstrated. They are fabricated similarly as the orange ones. In a certain voltage range, the blue light and the orange light combine to an emission that is white for the human eye (CIE coordinates x = 0.30 and y = 0.37). The maximum external quantum efficiency and brightness are around 0.3% and 1500 cd/m² respectively.

For more information, please contact:
Paul Heremans
Paul.Heremans@imec.be
tel.: +32 16 28 15 21

Blue OLED emits 37 cd/m² on 9 mA/cm².



Industry link

UMC and Virtual Silicon Technology join IMEC to offer 0.25 micron to the EUROPRACTICE MPW Service

EUROPRACTICE booth, 36th Design Automation Conference, June 21-25, Ernest N. Memorial Convention Center, New Orleans, LA, USA

A new route to low-cost ASIC prototyping and low-volume production is available from IMEC in the EUROPRACTICE IC Service, following an agreement between IMEC (lead partner of the EUROPRACTICE ASIC Service), UMC (Taiwan) and Virtual Silicon Technology (USA).
The agreement covers a Multi Project Wafer service on UMC's 0.25 micron CMOS process which features 5 layers of metal. Three MPW runs are currently scheduled by IMEC at UMC this year: June 99, September 99 and December 99.
The arrangement also provides for use of Virtual Silicon Technology's Diplomat-25 Advanced Cell Library (including standard cells and I/O cells, RAMs and EDA design kits). IMEC will deliver the phantom cells and EDA models and design kits to 500+ customers as part of its EUROPRACTICE CD-ROM design kit package.
Within the EUROPRACTICE MPW Service, IMEC offers training, back-end ASIC physical design, tapeout assistance, packaging and testing services. Customers worldwide can access the libraries and 0.25 micron MPW service through IMEC.

For more information, please contact:
Carl Das - Carl.Das@imec.be
tel.: + 32 16 28 12 48
http://www.imec.be/europractice/

IMEC strengthens its industrial training efforts: MTC, Microelectronics Training Center

Last month IMEC announced the launch of a new strategic initiative, the Microelectronics Training Center (MTC), that concentrates and expands IMEC's efforts in dedicated training for industrial partners, for IC designers, process operators and maintenance, process engineers and related domains.

Dramatic shortage

Market analysts, managers from leading semiconductor companies and government officials all state that the growing shortage of people with the right skills has become a major roadblock in the growth of the industry. New investment opportunities are being directed by the ability to find the right people or are even slowed down if one fails to find these people. This is a worldwide problem, and many countries and regions realize that concentrated actions should be taken to tackle this. This shortage is most pronounced in information technology jobs, but the problem is as bad in all segments of the information and communications technology industry. According to the European Union, in 1998 half a million positions were not filled, and they estimate that this will increase to 1.6 million in 2002, if nothing is done to solve this.

Dedicated training

Flanders has a worldwide reputation in education. On its 13,500 km^2, no less than 6 universities and 29 polytechnical schools can be found. The ever evolving information society calls for a workforce that is able to quickly adapt to new skills and knowledge. But it would be wrong to state that the educational system is not adapting fast enough to the needs of tomorrow. These long-term educational programs provide a necessary basis in terms of generic education, fundamental theory, problem solving and basic skills. Short-term and dedicated hands-on programs such as being offered by IMEC, are complementary to these educational programs. They are much more focused towards industrial needs, can be adapted at a much faster pace and teach special and dedicated skills that can be applied immediately, if necessary taking advantage of IMEC's unique infrastructure. Both programs are necessary.

MTC

In its 15 years of existence, IMEC has become the largest independent microelectronics R&D center in Europe, and cooperates with over 500 companies, institutes and universities worldwide. It has a staff of more than 820 people, 75% of which are engineers and scientists. Its concentration of know-how and experts — from chip design, process technology, microsystems, packaging, telecommunications, and related domains — makes IMEC well positioned to offer dedicated training services for the microelectronics and ICT community. From its inception, IMEC has always offered many training courses, especially in IC design (through its INVOMEC division), but equally so in other areas such as deep-UV lithography and telecommunications *(see Newsletter 23, November 1998).* The new initiative concentrates and expands these training efforts in a new microelectronics training center, MTC.

IMEC's new training center, which forms an integral part of its operation, focuses on microelectronics and related areas, including IC design, process technology and packaging. Courses are designed to meet the requirements of operators, technicians and engineers. In addition introductory courses in chip technology are planned for engineers and other professionals operating in related fields. The center's facilities are available to companies and institutions based in Flanders, in Europe and outside Europe.

Currently, the training package envisaged is unavailable at any one university or company, partly because of the multidisciplinarity and rapid evolution of the subject matter and the requested infrastructure. Through close collaboration with universities and other training establishments, IMEC offers complementary high quality training, focused on the most critical and strategic industry requirements. Training is also planned in conjunction with IMEC's industrial partners and in particular, custom training programs are planned for the near future in partnership with Alcatel Microelectronics and with CS2, Europe's recently launched advanced packaging, assembly and testing operation.

Overview of training programs at IMEC:

IC design (INVOMEC): part of European-wide EUROPRACTICE training services.

Training courses (more than 350 students from academia and industry):
- standard design tools;
- hands-on design training;
- advanced design technologies.

Process technology:
- standard tools;
- specialized courses (e.g. short course at ESSDERC, see "Events");
- custom training (hands-on, state-of-the-art equipment) (e.g. 248-nm deep-UV litho for ASML, 40 trainees each year).

Related domain:

IMEC expertise (packaging, microsystems, solar cells,…).

Custom training for operators and technicians:

in close collaboration with industrial partners and government employment organizations.

Postgraduate course telecommunications:
- in cooperation with universities and industry;
- more than 610 students;
- video conferenced all over Europe.

Training in IC technology:
- for engineers and scientists non-experienced in microelectronics;
- for non-technologists (managers, investment analists, accounting…).

For more information, please contact:
Jan Wauters - Jan.Wauters@imec.be - tel. +32 16 28 16 87
http://www.imec.be/training/ or http://www.imec.be/mtc/

Short course: Recent advances in device technology

September 12, IMEC

The purpose of this one-day short course is to provide a practical overview of the major advances, issues, and tradeoffs associated with emerging (deep sub-micron) processes and device technologies. The emphasis of the course will be on CMOS gate technology and emerging devices and silicon on insulator (SOI). The subjects will be presented from a practical perspective so the attendees can apply the material directly to their work. Specifically the course will explore the critical subjects of a) surface preparation prior to the gate dielectric; b) growth and properties of ultra-thin gate oxides; c) reliability of ultra-thin gate dielectrics, d) alternative gate dielectrics that may replace silicon dioxide; and e) silicon-on-insulator (SOI) devices and material issues.
The course is intended for scientists, engineers, and technologists working with device design, process development, process integration, and circuit design. Managers and technology executives who make decisions regarding technology directions will also benefit greatly from the overall perspective presented at this course.

For more information,
please contact the ESSDERC secretary (see 'Events').

C++ based hardware design of complex digital systems

September 12-17, Hilton Inn, Sunnyvale, USA

System on Chip design faces a multitude of requirements, which can only be met by innovative design methods. IMEC uses a C++ based technology to model, refine, and implement these complex systems in the most effective way. The course "C++ based hardware design of complex digital systems" teaches the techniques that allow this technology. These include object-oriented design, abstraction techniques, and incremental refinement from function to architecture. In the course, the OCAPI design environment for digital custom hardware design in C++ will be explained in detail, including elaborate hands-on exercises. The course teachers are the developers of OCAPI.
The course is intended for hardware designers from industry, system designers and researchers.

For more information,
please consult the IMEC US office or visit our training website-
http/:www.imec.be/training/Welcome. html.

A path towards sub-100 nm lithography

September 16, IMEC

The goal of this workshop is to exchange opinions among IC manufacturers and lithography tool suppliers concerning the future lithography technologies to be used for volume production.

The tentative program includes:

- scaling limitations of CMOS technology;
- the optical lithography roadmap;
- the status of electron projection lithography (SCALPEL);
- the status of 157 nm lithography and cost-of-ownership issues.

For more information, please contact:
Kurt Ronse
IMEC
Kapeldreef 75, B-3001 Leuven (Belgium)
tel. + 32 16 28 13 36 – fax + 32 16 28 12 14
Kurt.Ronse@imec.be

29th European Solid-State Device Research Conference (ESSDERC'99)

September 13-15, Leuven, Belgium

Main themes of this annual European forum are CMOS devices and reliability, silicon integrated technology, process and device modeling and simulation, interconnect technology and packaging, Si-based solid-state devices, displays and sensors, compound semiconductors and quantum electronics and manufacturing issues. The final program will be available early July 1999.
As a satellite event to ESSDERC, The European section of the Electrochemical Society will organize the Symposium "Analytical Techniques for Semiconductor Materials and Process Optimization" (ALTECH III), on September 16-17, Leuven, Belgium.

For more information,
please contact:
Linda Vanmeerbeek
IMEC
Kapeldreef 75,
B-3001 Leuven
(Belgium)
tel. +32 16 28 13 21
fax + 32 16 28 12 14
Linda.Vanmeerbeek@imec.be

Awards

Hugo De Man receives IEEE Signal Processing Society Award for Technical Achievement

The award was granted at the International Conference on Acoustics and Signal Processing, Phoenix, Arizona, USA, on March 15, for "contributions to design automation of digital signal processing systems". Hugo De Man received the award for his innovative computer-based design methodologies. These techniques permit to shorten the design cycle time of ever more complex electronics systems. Reducing time-to-market of new ideas increases the competitiveness of information and communication technologies industries.

Hugo De Man is full professor at the University of Leuven (K.U.Leuven) and senior fellow at IMEC. Examples of his work include the CATHEDRAL project, pioneering work in the field of design automation, later commercialized by Silvar-Lisco and one of the founders of DSP Valley, a high-tech valley concentrated around digital signal processing. DSP Valley now groups 15 companies, research institutes and universities.

Industry link

Erratum

GSM-based position location and tracking

In Newsletter 23, November '98 edition, we published technology news on a localization system using wireless cellular communication, developed by IMEC's associated laboratory ETRO at the University of Brussel. This report wrongfully stated that ETRO was "currently seeking industrial collaboration in various application domains such as telecom operators". The company SmartMove (IMEC's spin-off company, Leuven) has obtained an exclusive license agreement to commercialize this new technology development into its product portfolio. We apologize for any possible misunderstanding.

visit us at DAC and Semicon West

Professor Declerck appointed new president

On June 2, 1999, Professor Gilbert Declerck has been appointed president of IMEC, succeeding Professor Roger Van Overstraeten. Since November last year, Professor Declerck, 52, was chief operating officer of IMEC.
Professor Declerck received his PhD degree in electrical engineering from the University of Leuven in 1972, worked at the IC laboratories of Stanford University in 1973-1974 and joined the University of Leuven in 1974, where he became professor in 1983.

In 1984, he was appointed vice president of the Advanced Semiconductor Processing division of IMEC, and chief operating officer in 1998.

"We will carry on Professor Van Overstraeten's work", says Professor Declerck. "We will continue to make sure that IMEC in Flanders is known worldwide for its excellent research in process technology, design of systems-on-a-chip, telecommunications and multimedia, microsystems and optoelectronic components, solar cells and advanced packaging technologies."
Next to R&D, increased efforts will be devoted towards training the workforce for the semiconductor industry. "The future of the high-tech industry depends in an unprecendent way on the availability to find people that received the right training," according to the new president.

"The semiconductor industry is now entering a period of significant industrial growth, and new opportunities will certainly occur for a large R&D institution such as IMEC. More and more companies have to rely on joint R&D to be able to meet market demands and come up with the right solutions on time," says Professor Declerck.
"In the past downturn, we still experienced significant growth in our contract research income and we hope to benefit from the strong upturn in the industry.'

Events

Annual Research Review Meeting 1999

October 27-28, 1999, Leuven, Belgium

Last year's ARRM brought together more than 130 top managers from all over the world to get an inside in IMEC's latest developments and evolutions in microelectronics. In 1999, the 9th edition will take place on October 27-28.
The ARRM is also an excellent place for informal contacts and further discussions with IMEC staff members, industrial participants and officials of the European Commission. In addition, participants are informed, for one year, about important scientific breakthroughs at IMEC through the annual and scientific reports, newsletters and seminars.

For more information,
please contact:
Máry Sroczynski
Public Relations
IMEC
Fax: +32 11 24 18 66
http://www.imec.be/6/6.1.html

Patents granted - 4Q 1998 & 1Q 1999

Australia: Method of preparing solar cells front contacts (AU 702505)

Japan: Method of fabricating optoelectronic components (JP 518777/1993)

US:
- Local temperature sensing correction algorithm for high resolution in-situ electrical measurements (US 5833365)
- Method for processor modeling in code generation and instruction set simulation (US 5854929)
- A design environment and a design method for hardware/software codesign (US 5870588)
- Method of forming multiple-layer microlenses and use thereof (US 5871888)
- A programmable CDMA IF transceiver ASIC for wireless communications (US 5872810)

Publisher:

Prof. Gilbert Declerck,
President
Editor: Jan Wauters
IMEC
Kapeldreef 75,
B-3001 Leuven, Belgium
Tel. + 32 16 28 16 87
Fax + 32 16 28 15 76
E-mail: Jan.Wauters@imec.be
http://www.imec.be/5/5.2.3.html
Final editing: Chris Vanherck

Contributed to this number:

J. Bormans
F. Catthoor
S. Decoutere
B. Demey
M. D'Hondt
S. Donnay
C. Das
G. Groeseneken
P. Heremans
L. Hermans
H. Lebon
F. Potargent
P. Schaumont
D. Verkest

USA contact:

Rik Graulus,
Business Development Manager
IMEC, 960 Saratoga Ave, Suite 206, San Jose, CA 95129
Tel.: (408) 551 4501
Fax: (408) 551 4505
E-mail: graulus@imec.be
http://www.imec.be/

Request for more information

no 24 July 1999

imec newsletter

visit us at DAC and Semicon West

I want to receive more information on:

- ❑ High-quality InGaAs/AlGaAs lasers grown on Ge substrates
- ❑ IMEC strengthens its industrial training efforts: MTC, Microelectronics Training Center
- ❑ IMEC's Industrial Affiliation Programs (IIAPs) on deep-submicron processing
- ❑ IMEC's Industrial Affiliation Programs (IIAPs) on design technologies
- ❑ Other: ....

....

Please put me on your mailing list for following publications:

❑ IMEC scientific report ❑ IMEC annual report ❑ IMEC newsletter

Name	....	Phone	....
Job title	....	Fax	....
Company	....	e-mail	....
Address	....		
	....		

Main activities of the company are: ....

....

Please also put the following person on the IMEC mailing list:

Name	....	Phone	....
Job title	....	Fax	....
Company	....	e-mail	....
Address	....		
	....		

fax or send to:

Chris Vanherck, Public Relations Group, Business Development Unit
IMEC, Kapeldreef 75, B-3001 Leuven, Belgium
tel. +32 16 28 13 92 fax +32 16 28 16 37