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COMPOUNDS & ADVANCED SILICON

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Plumbing LED efficiency droop

LED overcapacity hits orders

Record 5GHz-bandwidth hybrid amp • IQE opens Singapore plant
Slowdown forces job cuts • Dual-junction PV hits 32.6%

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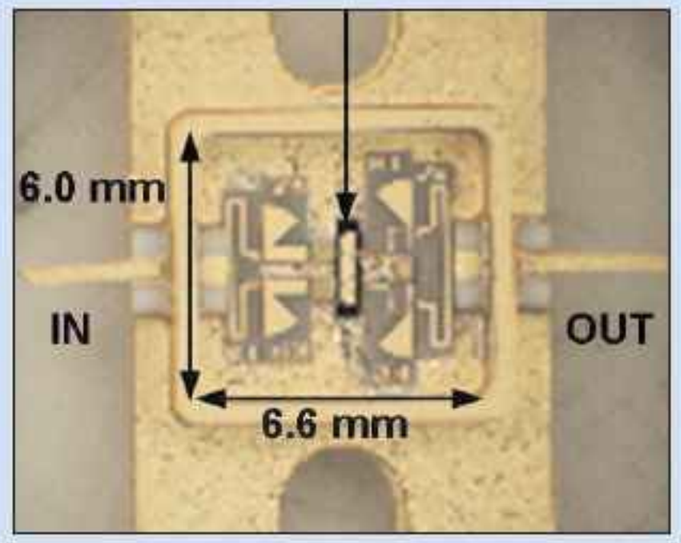

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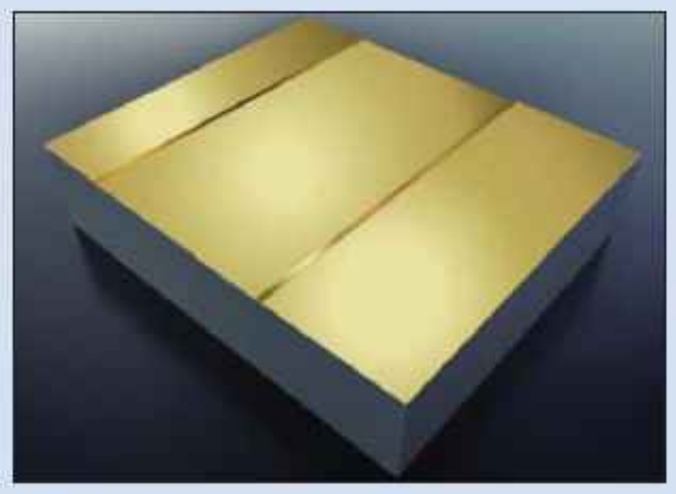

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editorial

Combating droop in LED-related business

Shortly after closing for press last issue, GaAs RFIC maker Anadigics announced cost-cutting measures involving about 100 job losses (15% of its staff — see page 8). Since its 28% drop in revenue in Q3/2008 is due to it being unable to expand fast enough to satisfy customers' demand, Anadigics loss of market share has benefitted rivals RFMD, Skyworks and TriQuint, which all grew (pages 6–12).

Despite the current macro-economic uncertainty, in Q3 mobile handset shipments still grew 8.2% year-on-year, according to ABI Research (page 4). However, ABI has lowered its forecast for year-on-year growth in Q4 from 10.4% to 7.5% (lowering full-year growth to just 10.5–11%). Correspondingly, as well as a further 20–24% drop in revenue for Anadigics, RFMD and TriQuint also expect their Q4 revenues to fall (with only Skyworks bucking the trend, thanks to its diversification into linear products).

Likewise, the market for LEDs in consumer products is being hit. Whereas LED maker Cree has grown 24% year-on-year, Q3 revenues were up just 3% on Q2, and chip sales are expected to fall further in Q4 (see page 36). Cree says that, for over a quarter now, there has been excess capacity among chip makers in Taiwan, which compete aggressively in low-to-medium end consumer applications. Cree expects consumer confidence to impact the markets that it serves, so the firm is taking a more conservative approach to operating expenses and capital spending in the near term.

Sapphire supplier Rubicon has also been hit by falling demand for small-diameter (2–3″) substrates for LEDs in handheld and small-display markets, contributing to an expected dramatic revenue drop this quarter (page 34).

Similarly, Aixtron and Veeco have both reported declines in orders of MOCVD reactors in Q3 (pages 26–27). Aixtron attributes this to an expected 'digestion' phase in the investment cycle for backlight-LED capacity expansion. Veeco suffered its sharpest drop in MOCVD orders as LED makers (especially in Taiwan and China) digest the 'significant number' of systems bought in the last year (leading to $9m of order push-outs due to the overcapacity). "The constrained financing environment may cause a broad slowdown in capital equipment purchases," adds Veeco's CEO John R. Peeler.

Nevertheless, both Aixtron and Veeco are continuing to invest in R&D and manufacturing for mid- to long-term prospects. Rubicon is also investing in newer, more efficient equipment, capitalizing on LED makers moving to larger-diameter substrates. Also, to support growth in LED component and lighting product sales, Cree still plans capital expenditure of $15–18m this quarter, targeting the continuing transition of production to 4″ SiC wafers.

Despite any short-term slowdown, equipment suppliers traditionally focused on the harder-hit silicon industry can still find refuge in the compound semiconductor industry, with Tegal (page 28) and FSI (page 22) winning LED- and GaAs-related orders, respectively. In particular, next issue we will report how compound-related business is offsetting Aviza's sharp decline.

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***Semiconductor Today* covers the R&D and manufacturing of compound semiconductor and advanced silicon materials and devices** (e.g. GaAs, InP and SiGe wafers, chips and modules for microelectronic and optoelectronic devices such as RFICs, lasers and LEDs in wireless and optical communications, etc).

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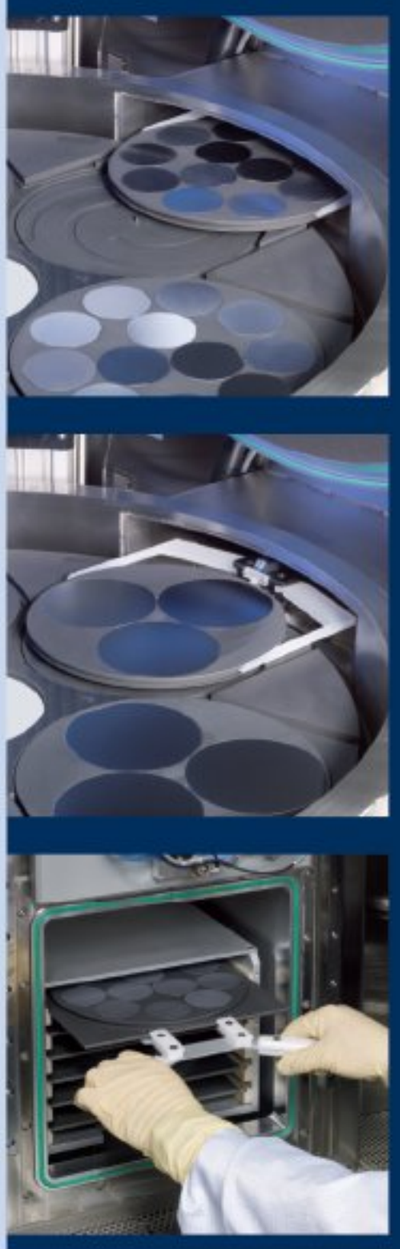

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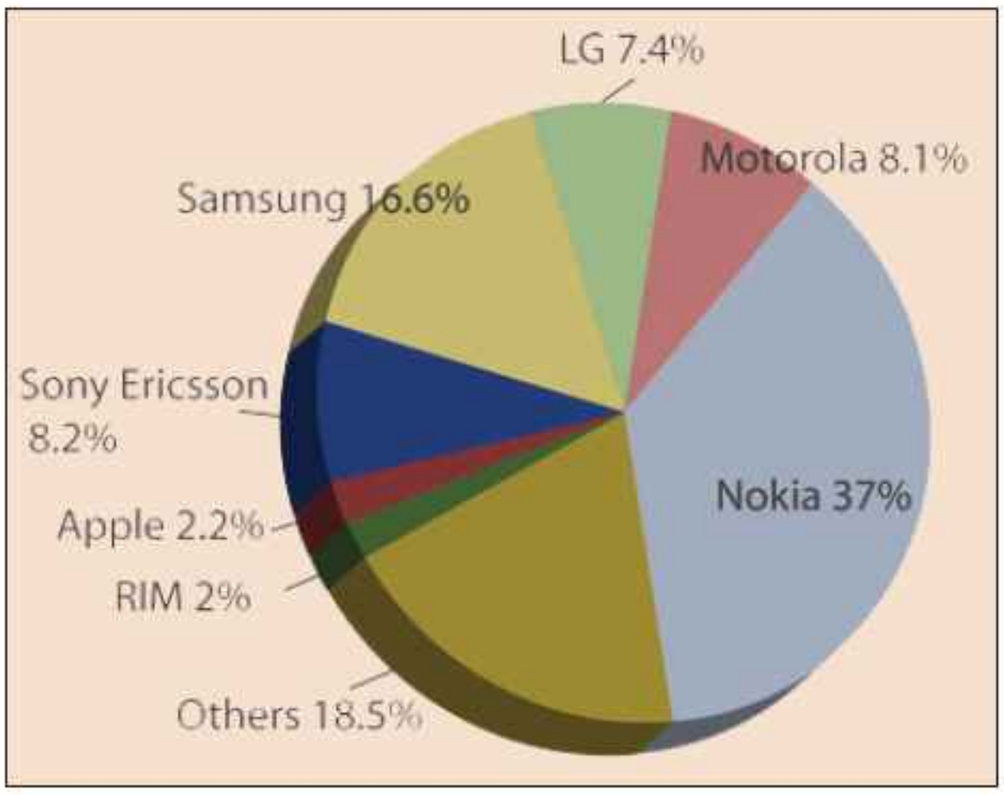
Mobile shipments still rose in Q3, despite credit crunch

Despite the uncertainty of the current macro-economic situation, in Q3/2008 mobile handset unit shipments still grew 8.2% year-on-year, says market research firm ABI Research.

"Given the traumatic news ricocheting around the financial markets, one would almost expect mobile handset markets to have nose-dived", says ABI's Asia-Pacific VP Jake Saunders. While mobile phones can be viewed in part as fashion accessories, they also impart other value propositions that are highly valued by end-users. Substantial improvements in key functional areas (memory, battery life, data speed, processor speed) are being noticed by end-users. Still, many are opting to remain on open contracts rather than upgrade their handsets and lock themselves into downpayments for new phones and potentially expensive monthly commitments.

The positive news is that handset vendors are reporting that input costs for handsets are on a downward curve. Vendors have also refreshed their handset portfolios and have strengthened their mid- and low-tier handset line-ups to appeal to end-users on tighter budgets.



Mobile handset market shares in Q3/2008.

Nokia's market share shrank slightly to 37.7%, but it would have fared worse were it not for its strong line up in the mid- and low-tier handset segments, which is where LG and Motorola felt the impact (shrinking to 8.1% and 7.4%, respectively), according to ABI's research director Kevin Burden. SonyEricsson managed to maintain its market share at 8.2%. Winners include Samsung (16.6%), Apple (2.2%), and RIM (2%).

In particular, smart-phones are capturing the imagination of the buying public, which is benefitting the corresponding vendors. Nokia may therefore claw back some of its lost market share, as it now has stronger products in the smart-phone category.

However, ABI has lowered its forecast for year-on-year growth in Q4/2008 from 10.4% to 7.5%. Full-year growth is now expected to be 10.5–11% (to 1.27bn shipments).

Q4 will therefore now be a vital quarter for handset vendors and mobile operators, ABI concludes. We should expect to see aggressive marketing and promotional activities from operators and vendors alike as they strive to lure end-users to upgrade their handsets before the year's end.

www.abiresearch.com

Double-digit growth to $4bn forecast for wireless LAN integrated circuits in 2012, driven by 802.11n technology

The wireless LAN (WLAN) semiconductor market is expected to increase at a compound annual growth rate (CAGR) of 22.8% to more than $4bn by 2012, according to a study 'Worldwide WLAN Semiconductor 2008-2012 Forecast' by IDC.

While PCs will remain the largest application segment, mobile phone applications will grow at 49.3% to become the second-largest category by 2012. However, IDC expects (multiple-input and multiple-output)-enhanced 802.11n technology to be the next growth driver for this market, as its higher throughput and range provide a great opportunity for new applications and usage models.

"The need for connectivity and connected mobile clients continues to fuel the WLAN semiconductor market," says Ajit Deosthali, IDC's research manager for Short Range Wireless Semiconductors. "WLAN adoption is set to grow beyond notebook PC and into the mobile phone and consumer electronics devices," he adds.

WiFi is set to take off in mobile handsets with dual-mode phones that provide both conventional cellular and WLAN connectivity

In addition, WiFi is set to take off in mobile handsets with dual-mode phones that provide both conventional cellular and WLAN connectivity. Connectivity is the fastest-growing segment for semiconductor companies, with WLAN leading the way. Mobile handsets and mobile internet devices will lead the integration of WiFi radio with other radio technologies such as Bluetooth, FM, and GPS for personal area networks, IDC concludes.

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RFMD improves operating income after restructuring

For its fiscal second-quarter 2009 (ended 27 September), RF Micro Devices Inc of Greensboro, NC, USA has reported revenue of $271.7m, up 6.2% on $255.8m a year ago and up 13% on last quarter's $240.5m.

The sequential increase reflects RFMD's CPG Cellular Products Group gaining market share in cellular front ends (with growth exceeding the handset industry growth rate) as well as growing sales for Polaris transceivers. Consequently, RFMD increased its dollar content in cellular handsets, as transmit module adoption increased and as leading handset makers launched new phones featuring Polaris 2 and Polaris 3. RFMD shipped production volumes of cellular front ends to all five of the world's top-five handset original equipment manufacturers (OEMs), as well as securing major 3G design wins at more than one of them.

In RFMD's MPG Multi-market Product Group (for non-cellular handset products) the integration of recent acquisitions — e.g. Sirenza Microdevices Inc in November 2007 and Filtronic Compound Semiconductor of Newton Aycliffe, UK (now RFMD UK) this February — has been completed, with synergies continuing to be recognized, says the firm.

During the quarter, MPG released 18 new products (bringing the total in fiscal first-half 2009 to 45) and is on track to release more than 100 new products in fiscal 2009. Also during the quarter, RFMD received US government funding for its gallium nitride process development and anticipates signing a new government contract in the December quarter. Revenue from GaN-based line amplifiers for cable TV (CATV) should begin in calendar 2009. RFMD expects to exceed its goal of $250m in MPG revenue this fiscal year.

RFMD's overall gross margin has fallen from 32.2% a year ago and 30.1% last quarter to 28.3%, due mainly to the sequential increase in Polaris transceiver revenue. Though cut from $24.1m last quarter, net loss was still $11.8m (versus net income of $14.5m a year ago). However, excluding charges related to the strategic restructuring announced on 6 May, non-GAAP net income was $18.6m, up from $7.9m last quarter (though still down on $23.4m a year ago).

"Two quarters ago we announced a strategic restructuring that positioned RFMD to deliver the largest increase in profitability in our company's history," says president & CEO Bob Bruggeworth. The restructuring has involved focusing investment on RFMD's core RF components and compound semiconductors (including cellular front ends and other components in CPG as well as high-value RF components in MPG) by eliminating all product development expenses related to wireless systems, including cellular transceivers and GPS solutions. About 300 redundancies were involved.

"With the efforts related to our strategic restructuring complete, we've improved both our operating model and our competitive position," adds Bruggeworth. Progress includes expense reductions, market share gains and non-GAAP operating income of 6.6%, an improvement of 12.7 percentage points. RFMD has achieved its goal of eliminating $75m in annualized CPG expenses, while improving its outlook for increases in free cash flow (after generating about $40m in operating cash flow in the September quarter). "RFMD has delivered on its commitments to increase revenue, operating margin and cash flow over the past two quarters," says Dean Priddy, chief financial officer & corporate VP of administration. RFMD's free cash flow exceeded non-GAAP earnings in the September quarter.

"We expect our restructuring to serve us well regardless of the market environment, both in the face of an apparent global slowdown and as markets ultimately return to strength," says Bruggeworth. "Clearly, no company is immune to macroeconomic conditions. However, on the strength of our restructuring, and given our scale, end-market diversity, improving product portfolio and low-cost structure, we believe we are well-positioned to execute on our growth plan."

RFMD experienced strong order flow during the September quarter and currently sees customer demand to support revenue growth in the December quarter. However, due to uncertainty currently surrounding the global macroeconomic environment, RFMD believes it is prudent to be conservative and factor down customer demand forecasts.

So, for the December quarter, RFMD forecasts revenue to be flat to down 7% on the September quarter. Nevertheless, based on projected customer and product mix along with reduced expenses, it expects operating margin to rise.

Due to the macroeconomic environment, plus its restructuring, RFMD has an opportunity to leverage its market, product and customer diversity, and manufacturing scale to increase its market share and dollar content, maintain profitability and increase cash significantly, concludes Priddy.

Due to the macroeconomic environment... RFMD has an opportunity to increase its market share and dollar content

www.rfmd.com

3G portfolio broadened with highly integrated WCDMA/HSDPA power amplifiers

RFMD has broadened its portfolio of 3G front ends for the open market with the highly integrated RF3267 and RF6266 WCDMA/HSDPA power amplifiers (PAs), which are designed to support next-generation, multi-band, multimode 3G handsets and smartphones.

RF3267 is a Band 1 (1920–1980MHz) WCDMA/HSDPA PA with a digitally controlled low-power mode, which allows operation up to 19dBm with reduced current consumption. An integrated coupler allows elimination of the external coupler traditionally placed at the output of the PA. The integration of additional functionality is achieved without expanding the 3mm x 3mm x 0.9mm package size (first used for the prior-generation RF3266 PA). Maintaining pin-for-pin compatibility helps handset OEMs to shrink RF sections in support of more compact and thinner devices.

The RF6266 mixes a similar feature set and a 3mm x 3mm x 0.9mm package with the ability to operate in either Band 5 (824–849MHz) or Band 8 (880–915MHz). In combination, the RF3267 and RF6266 provide a compact solution for multi-band, multimode 3G handset designs for the North American or European Union (EU) markets.

RFMD is capturing additional 3G revenue as it introduces cellular front-end standard products to the open market and as increasingly complex 3G multimode handsets require extra content, including duplexers, filters and front-end power management. Most handset makers use standard products for their cellular front-ends, and RFMD expects to launch a record number for the open market in 2009.

- The RF3267 and RF6266 have been selected by Samsung to support an upcoming high-volume 3G handset platform.

"Our participation on this high-volume platform underscores our design momentum at Samsung and demonstrates our commitment to supporting their success across all major air interface standards," says Eric Creviston, president of RFMD's Cellular Products Group.

SUF family extended with broadband pHEMTs

RFMD has added four broadband GaAs pHEMT amplifier ICs to its SUF range, targeting applications in aerospace & defense (A&D) and — given their broadband frequency performance — adjacent growth markets including telecom infrastructure and optical networks.

RFMD says that the SUF-7000, -8000, -8500 and -9000 die-level amplifiers extend the SUF family's operational frequency range from DC to 20GHz, and deliver multiple combinations of P1dB, gain and linearity performance.

In many A&D applications, die-level amplifiers are preferred since they have superior high-frequency performance versus packaged parts, enable flexibility for integration and help end-product designers to achieve smaller board layouts.

"Given the broadband frequency performance requirements of our defense customers, we are able to simultaneously deliver a family of new high performance ICs which address both military and non-military opportunities with the same IC solution," says Jeff Shealy, VP & general manager of RFMD's Aerospace and Defense business unit. "Intelligent re-use of RF circuit design combined with our Optimum Technology Matching strategy are key to our ability to accelerate penetration in multiple RF markets."

For other markets (e.g. test & instrumentation) that find it difficult to use die-level products in various applications, RFMD is also releasing packaged versions of select SUF amplifiers for production in Q1/2009.

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IN BRIEF

RFMD's millionth point-to-point radio

RFMD has shipped its one millionth IC for high-performance microwave point-to-point (PTP) radio applications (including broadband communications and cellular backhaul networks).

"RFMD now offers a broad portfolio of high-frequency amplifiers and radio chipsets operating up to 26GHz," says John Pelose, general manager of RFMD's Wireless Infrastructure business unit. "Our expanded capabilities in microwave radio applications are fostering new growth opportunities for RFMD, not only in PTP radios but also in aerospace & defense."

RFMD extended its microwave IC product portfolio with February's acquisition of Filtronic Compound Semiconductors Ltd in Newton Aycliffe, UK and continues to strengthen its PTP portfolio. The firm claims it offers the broadest portfolio of RF components for microwave PTP radio applications, including radio chipsets, MMIC amplifiers, discrete transistors, high-power high-frequency switches and signal sources (VCO and PLL modules).

Demand for microwave PTP radios in cellular backhaul applications is continuing to grow, as cellular infrastructure networks support global increases in voice and data services such as mobile video. In cellular backhaul, PTP radios are used to wirelessly connect base-stations to a mobile operator's core network, providing an alternative to the costly and throughput-limited leased line transport approach. Also, PTP radios continue to migrate to higher carrier frequencies to support increased data rates in cellular backhaul.

As well as cellular infrastructure, new markets include trunking, enterprise networks, broadcast networks and last mile access.

Anadigics cuts 15% of workforce

For Q3/2008 GaAs component maker Anadigics Inc of Warren, NJ, USA has reported revenue of $58.1m, down 27.8% on last quarter's record $80.5m and down 2.4% on $59.5m a year ago. This is also well short of August's guidance of $62–65m (which was already a revision from July's initial guidance of $75–81m).

About $3m of the shortfall came from order rescheduling in the broadband segment by wireless LAN customers including Intel (reflecting the weaker economic environment, as well as Intel taking on a second source of power amplifiers).

Of total revenue, wireless contributed $29.3m (down 14% on a year ago and 41% sequentially) and broadband contributed $28.8m (up 12.6% on a year ago but down 7.6% sequentially), with the latter being about half for WLAN and half for set-top box/cable infrastructure.

Compared with net income of $2.4m a year ago and $6m last quarter, net loss was $15.5m. Pro forma earnings (excluding non-GAAP adjustments of $15.5m) was break-even, compared with a profit of $11.6m last quarter. Gross margin was 31.5%, down from 38.4%. During Q3, capital expenditure was $12.4m, and cash and short- and long-term marketable securities fell from $161.4m to $152.2m.

Anadigics' record revenue of $80.5m in Q2 represented a 13th consecutive quarter of growth (up 49% year-on-year), leading to July's decision to accelerate construction of its 6" GaAs wafer fabrication plant in Kunshan, China (doubling investment in the build-out from $50m to $100m, to enable completion by October and start up in Q3/2009, ultimately doubling the firm's existing capacity in Warren).

However, quarterly revenue of $80m is not a sustainable capability. "The fab had been pushed too hard, basically to overheating," says Gilles Delfassy (who has been chairman & interim CEO since the resignation of president & CEO Dr Bami Bastani in mid-August). "When we weren't able to meet some of our customers' increased demand during the past several quarters, they looked for other sources of supply," he adds. "Our Q3 performance primarily reflects loss of market share [after having to put some customers on allocation]." Due to this, as well as a weakening economy, in early August Anadigics decided to delay the extra investment in the China fab (scaling back from $100m to $50m again) until it has better visibility as to when the fab needs to become operational.

Anadigics is committed to CapEx of $15m in Q4, mainly in China. However, "We have not made any decisions recently to spend any CapEx, especially on the China fab," says Delfassy. "The last thing we want to do now is continue to spend... now is the time is to turn CapEx that we have already spent into additional capacity and revenue."

In Q4, Anadigics expects revenue to fall a further 20–24% to $44–46m (down 32–35% year-on-year), due mostly to WLAN broadband revenue. Gross margin may be just 24.5–26%.

"In light of the change in quarterly revenue along with the uncertain macro-economic environment, we are taking immediate measures to realign our cost structure [relative to demand] across the company," says chief financial officer Tom Shields. "These actions will have a significant impact on our operating performance in the near term without compromising our new product design and development," he reckons. Design activity is strong, so the firm wants to protect its R&D efforts.

"We certainly have work to do to regain the trust and confidence of our customers, but I am optimistic," Delfassy comments. "We are making the necessary changes to solidify our operations in order to deliver what our customers expect from us."

The first step to recovery is installing the right procedures and total quality system to make the Warren fab capable of doing $80m in revenue on a sustainable basis, not just once at the expense of the next quarter and the quarter after, Delfassy states. "We are going for a complete overhaul of our operations to improve our execution and productivity, starting with our leadership." Anadigics recently replaced its head of operations with Sunil Banwari (who spent over 20 years at Intel, mostly in technology and manufacturing), and has new fab, processing and equipment managers. "With improved operational performance and continued product differentiation, I'm confident we can regain our market position and resume revenue growth and profit," Delfassy says.

Anadigics is implementing cost reduction measures across the firm that include the elimination in early November of about 100 jobs (about 15% of its workforce).

The goal is to achieve savings of $15–20m on an annual basis, starting late in Q4/2008, says chief financial officer Tom Shields.

"These actions are prudent in light of the change in quarterly revenue, while preserving our capabilities to meet future customer demand and maintain a strong balance sheet."

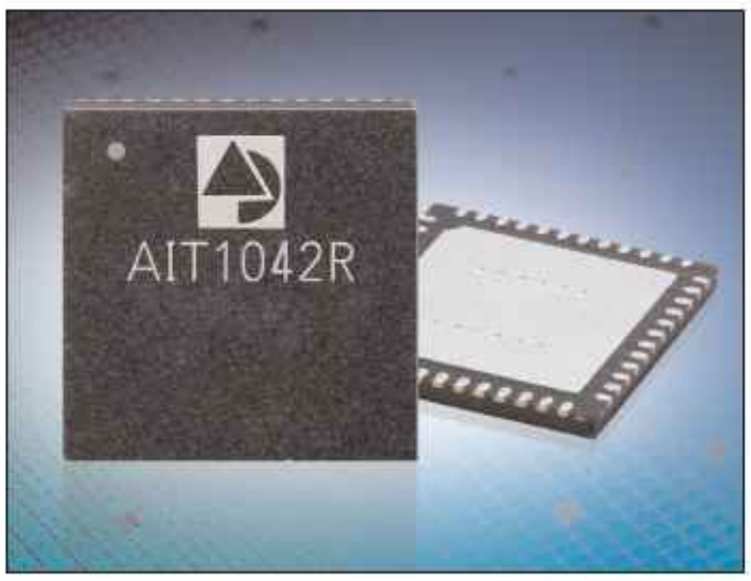
"This was a difficult decision because of the impact it has on people, but was a necessary step in our plan to return the company to growth and profitability as soon as possible," says Gilles Delfassy. "We are continuing critical investments in new products and other strategic initiatives that focus on making our customers successful."

Pre-tax charges of $2.2–2.4m due to severance costs and one-time benefits are expected in Q4/2008.

Integrated 1GHz digital tuner for space-sensitive video

Anadigics has launched the AIT1042, a fully integrated 1GHz-bandwidth tuner IC that provides high linearity and low noise to deliver crystal-clear digital video in today's cable TV (CATV) systems with densely loaded spectrum. Anadigics says that the device's high levels of performance and functional integration, combined with its small package size and ease of use, suit use in the new generation of digital video receivers.

Developed for use in CATV and HDTV tuners, set-top boxes and PC TV tuner cards, the highly integrated AIT1042 minimizes board layout sensitivities, reduces the amount of external circuitry required for a complete receiver solution, and minimizes board layout space, the firm claims. The new RF tuner uses GaAs and silicon technology to combine an upconverter with RF gain control, a downconverter, a digital IF amplifier



Anadigics' AIT1042 tuner IC.

with gain control, two voltage-controlled oscillators (VCOs) and a dual synthesizer into a single 7mm x 7mm x 1mm 48-pin surface-mount package.

Operating from a single +5V supply, the AIT1042 generates 78dB of gain (including external filter losses) while converting a 50–1000MHz RF input signal to a 35–50MHz digital IF output. The device maintains high linearity and low noise over a wide gain control range, which is adjustable up to 40dB at the RF input and up to 45dB in the IF amplifier. Integrated on-chip oscillator tank circuits reduce component count and eliminate the need for any post-assembly manual adjustments.

"As the industry migrates toward 1GHz infrastructure and all-digital content, this new tuner delivers the exceptional levels of performance needed to support the high-quality video that consumers demand today," claims Ron Michels, senior VP & general manager of Anadigics' broadband business.

In addition, the high level of integration suits use in space-sensitive applications such as PC TV tuner cards and multiple-tuner set-top boxes, he adds.

The AIT1042 is available at $3.88 each in quantities of 5000 units. A device evaluation board as well as a complete tuner-demodulator reference design are also available.

Anadigics launches its first power amplifier for femtocells

Anadigics has launched the AWB7220 power amplifier (PA), the first in its new line of products targeted at the 3G and 4G femtocell markets.

The AWB7220 PA is a highly isolated, fully matched, multi-chip module (MCM) designed and engineered specifically for use in femtocell and customer premises equipment (CPE) worldwide.

Femtocells solve the problem of weak or non-existent wireless broadband signals in SOHO environments by connecting users' mobile devices to their carrier's network through a high-speed Internet link. Because they are inexpensive and easy to install and operate, sales of femtocells are expected to ramp up significantly in 2009. Analyst firm ABI Research sees the femtocell market increasing to double-digit millions in volume during 2010. "We expect cellular-based femtocells to take the baton from UMA- and SiP-based Wi-Fi solutions by 2013, seizing 62% of the 103 million unit access point market," says ABI VP & research director Stuart Carlaw. ABI also expects femtocell prices to drop to the range of wireless routers in 2010.

"The femtocell market is an exciting place to be right now... It's a milestone in the convergence between consumer electronics and commercial network infrastructure," comments Joe Cozzarelli, Anadigics' director for Wireless Infrastructure and 4G Products. "We're leveraging Anadigics' proven, core GaAs technology and our engineering expertise to design and manufacture a comprehensive product line with the exceptional linearity, high power, optimized performance and integrated functionality required by femtocell equipment designers and manufacturers," he claims.

We expect cellular-based femtocells to take the baton from UMA- and SiP-based Wi-Fi solutions by 2013

The AWB7220 is a 4.5V module that operates at 2.5–2.7GHz with extended operational capability between 2.3GHz and 2.5GHz. Designed specifically for OFDMA waveforms such as 802.16 WiMAX, the new module delivers 28dBm (P1dB = 35dBm) output power with 30dB of gain.

The AWB7220 is manufactured using Anadigics' proprietary InGaP-Plus technology. Its self-contained 7mm x 7mm x 1mm surface-mount package incorporates matching networks optimized for output power, efficiency and linearity in a 50Ω system.

www.anadigics.com

Skyworks grows 22% year-on-year to record $233m revenue

For its fiscal fourth-quarter 2008, Skyworks Solutions Inc of Woburn, MA, USA, which manufactures linear products, power amplifiers, front-end modules and radio solutions for handset and infrastructure equipment, has reported record revenue of $232.6m, up 8% on last quarter's $215.2m and 22% on $190.5m a year ago (and exceeding July's guidance of $225m).

Due to higher equipment efficiencies, progress on yield improvement initiatives, and double-digit year-on-year material cost reductions, non-GAAP gross margin has improved for the sixth consecutive quarter (to 40.8%, from 40.6% last quarter and 39.4% a year ago). Net income was $54.8m, more than double $20.5m last quarter.

Skyworks has also reported a sixth consecutive quarter of improving cash flow, generating $52m from operations (totalling $174m for fiscal 2008). Capital expenditure was $13m. The firm also retired $62m of convertible debt.

In fiscal 2008, Skyworks doubled its smart-phone front-end module (FEM) shipments year-on-year, to more than 40 million units, as its Intera portfolio of FEMs supports the rapid growth in the emerging smart-phone segment. Reflecting increasing diversification into adjacent markets within its Linear Products business, during the quarter the firm also secured a five-year, multi-million dollar defense contract with Lockheed Martin of Bethesda, MD to supply high-precision microwave components for radar applications, airborne aircraft carriers, and fighter jets. Skyworks also ramped shipments of smart meter reader solutions, and launched a portfolio of voltage-controlled oscillators, frequency synthesizers, mixers and amplifiers targeting home area networks and industrial automation.

"While we certainly feel the impact of the market downturn, we're fortunate that we have several product investment areas that are just now beginning to ramp," says president & CEO David J. Aldrich. "We're not as vulnerable to a single-point issue with a customer or a couple of customers. We have some programs with pretty high average selling prices (ASPs)."

While we certainly feel the impact of the market downturn, we're fortunate that we have several product investment areas that are just now beginning to ramp

The migration to higher-end 3G and smart-phone devices — though happening more slowly than expected, given the current economy — expands Skyworks' addressable market by billions of dollars, from roughly $2 per phone in 2G to $6 in 3G multi-mode (a 3x increase), reckons Aldrich. "We're uniquely able to sweep in switching, logic, filtering and wireless local-area network functionality," he adds. "Market share gains [e.g. from troubled rival Anadigics], along with this higher-dollar-content multi-mode content trend, are having a compounding effect on the top line of our business. This trend is enabling us to continue to grow even under the most pessimistic handset forecast scenarios."

"Customer and market diversification along with strong execution are enabling us to continue growth," says Donald W. Palette, VP & chief financial officer. Growth in new customer platforms more than offset broad market softness. Skyworks has now partnered with all the top base-band OEM manufacturers. "We're continuing to diversify within our handset business, with increasing support of all five top Tier 1 handset OEMs as well as two of the leading smart-phone suppliers," adds Aldrich.

"As our smart-phone unit growth trajectory at two times the market growth rate highlights, we're clearly gaining market share. We're beginning to demonstrably outperform our traditional markets, while also penetrating new applications," he adds. "In fact, the weakening industry backdrop is accelerating vendor share consolidation as both our linear and cellular handset customers increasingly award programs based on highly integrated, low-cost architectures, innovative roadmaps, operational scale and balance sheet strength," reckons Aldrich.

Based on its strong order backlog, for fiscal Q1/2009 (to end-December) Skyworks expects a further rise in both revenue (to $240m) and gross margin (to 41–41.5%).

"Our guidance incorporates current market uncertainty and, at the same time, reflects Skyworks' ability to outperform our addressable markets," says Aldrich. "Skyworks' record performance and growth outlook despite the slowing global economy demonstrates solid progress in our strategic plans to diversify, gain market share and deliver continued operational improvements."

In addition, Skyworks is executing process qualification for transitioning its GaAs fab in Newbury Park, CA from 4" to 6" wafers (on track for late 2009–2010). In the meantime, it has HBT foundry Kopin as a partner to ramp 6" externally, creating a 'buffer' of capacity. "We could actually do an in-line transition, machine by machine, process step by process step, without any disruption," says Aldrich.

www.skyworksinc.com

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TriQuint's profit triples, but sales dip expected in Q4

For Q3/2008, RF product maker and foundry services provider TriQuint Semiconductor Inc of Hillsboro, OR, USA has reported record revenue of $186.3m, up 52% on $122.9m a year ago and up 47% on Q2's $127m. Of total revenue, 55% was for handsets, 37% for networks, and 8% for military markets.

Growth was driven by handset-related revenue rising 54% year-on-year and 65% sequentially. This includes 195% for 3G handsets (which have 3–4 times the RF content of previous phone generations — more than $6 and rising as more bands are added — and which now represent the largest portion of handset revenue, at $62.5m).

Military product revenue grew 22% year-on-year and 7% sequentially, with solid demand for radar retrofit products and SAW filters for communication applications (driving a record quarter for passive devices).

Boosted by revenue of $13.9m from WJ Communications Inc of San Jose, CA (acquired in May for $72m), which supplies GaAs-based RF products for wireless infrastructure, RFID and WiMAX markets, revenue for networks applications was up 59% on a year ago and 28% sequentially, driven by optical product and wireless local-area-network (WLAN) sales. In particular, WLAN revenue grew 174% year-on-year and 33% sequentially (following a strong Q2), with Wi-Fi (particularly 802.11n) expanding the RF content in laptops by 2–3 times. Similarly to 3G, RF content for WLAN has increased as the requirements for greater data rates and faster access have increased.

Driven mainly by the inclusion of a first full quarter of WJ's expenses, operating expenses have risen from $41.8m last quarter to $46.3m. Despite this, net income more than tripled to $11.8m from $3.4m in Q2.

"TriQuint delivered unprecedented revenue growth in the quarter and solid bottom line results," comments president & CEO Ralph Quinsey. "Each of our markets [handsets, networks and military] is contributing to our growth... We are gaining share in virtually all of our markets."

However, non-GAAP gross margin was 33%, down from Q2's 37%. Of the 4% drop, about 2.7% was due to precious metals pricing (as well as record usage while bringing new equipment online) — gross profit was reduced by $5m after platinum reclaim prices halved to about $1000 per ounce (following a big rise before July). In addition, about 1.3% of the drop was due to delays in reaching targeted yields in ramping up capacity for two major new platforms: one in WLAN and one in handsets (the Tritium 3G PA duplexer front-end module).

Quinsey cautions that, regarding the new 3G and WLAN platforms driving growth, TriQuint was "filling an empty pipeline" for the products, as customers built inventory in anticipation of future requirements. The impact drove run rates higher than the normal. However, this was creating demand above the level of end-product demand. "We will see some leveling and some retrenching," warns Quinsey. "In the fourth quarter, we'll feel some resetting of that demand."

In the fourth quarter of 2008, we'll feel some resetting of demand

As well as some handset customers working inventory levels down, orders are slowing in response to the economic uncertainty (and likewise with network customers), says Quinsey. "Across all of our markets I am seeing great uncertainty," he adds (although military bookings are fairly healthy, so revenue is expected to grow sequentially since the business is more detached from the day-to-day realities of the economy than the other businesses).

"Typically, at this time of year, the whole world is bulking up anticipating a selling season, and then they take stock in Q1 and readjust," says chief financial officer Steven J. Buhaly.

In contrast, for Q4/2008, TriQuint expects revenue to fall back to $160–175m. TriQuint is currently about 90% booked to the mid-point of this revenue guidance. Nevertheless, based on this, TriQuint still expects record revenue for full-year 2008 (boosted by major design wins in mobile phones, WLAN laptops, and defense markets).

Regarding the new products, Quinsey expects improved yields and healthy gross margin, with growth for these programs resuming in 2009 after near-term order slowing to balance inventories.

"For 2009, we have a healthy new product pipeline," he says. The roadmap includes next-generation Tritium modules, growth in WLAN for handsets, flip-chip-based power amplifier modules, radar programs in military that are transitioning to production, and high-voltage GaAs products that are opening up new markets. "I am confident any slowing in growth will be largely attributed to economic slowing, and TriQuint will use this period to expand our market share," reckons Quinsey. "The firm is well positioned in the 3G handset market, where we expect the growth rate to be well above the overall handset growth rate, offering us the opportunity to buck the trend," he adds. "Apart from this crisis and the slowdown it may bring, we continue to see long-term market growth and growing content for RF suppliers."

www.triquint.com

TriQuint launches mmWave GaAs foundry processes

RF front-end product maker and foundry services provider TriQuint Semiconductor Inc of Hillsboro, OR, USA has introduced two 150mm high-volume GaAs processes for millimeter-wave applications.

The new pHEMT processes use optical lithography technology to reduce cost compared to traditional electron-beam-based solutions. The TQP15 and TQP25 processes join the 0.13μm TQP13 process (announced in January), expanding TriQuint's commercial foundry pHEMT offerings to cover the entire range of mmW frequencies.

"The cost efficiencies enabled by utilizing optical lithography in place of more traditional e-beam offers a broader range of customers the ability to develop millimeter wave applications," says Mike Peters, director of marketing for Commercial Foundry at TriQuint. "This disruptive price point will help bring mmWave applications into the commercial market space."

TQP25 enables the design of high-throw-count switches, such as those used in 3G WCDMA mobile handsets. High-throw-count switches enable access to multiple frequency bands from a single antenna, reducing the overall RF front-end footprint.

TQP25 is also suited to Ku-band power amplifier (PA) designs and, as an enhancement/depletion (E/D) process, it allows integration levels not typically available at these frequencies, says the firm. TQP25 is available on limited release.

Developed from the same base technology as TQP13 & TQP25, TQP15 targets the Ka-band segment and is suited to VSAT, satcom and point-to-point radio markets. TQP15 is on limited release at the end of 2008.

"TriQuint is the industry's leading gallium arsenide foundry services provider and continues to expand its process portfolio," says Asif Anwar, program director of the GaAs Service at Strategy Analytics. "TriQuint's new 0.15μm and 0.25μm processes will help the VSAT industry address future trends that include implementation of Ka band-based broadband services, which we see as a growth area, as well as target other commercial millimeter-wave markets with cost-effective solutions."

www.triquint.com

Parameter	TQP15	TQP25	
T-Gate	0.15μm D	0.25μm D	0.35μm E
Bv(min)	12	10	10
Bv(typ)	14	12	12
Vp(v)	–1	–0.9	0.3
$I_{d\,ss}$(mA/mm)	310	250	100
I_{max}(mA/mm)	550	550	375
f_T(GHz)	85–100 (peak)	45@$I_{d\,ss}$	45@50% I_{max}
f_{max}(GHz)	Tbd	125@$I_{d\,ss}$	110@50% I_{max}
G_m	400	450@$I_{d\,ss}$	650@50% I_{max}
Passives	50Ω NiCr Resistor, 620pFmm^2 MIM capacitor		
Interconnect	1 local, 1 global with BCB dielectric		

IN BRIEF

Raytheon 4-star supplier excellence award for TriQuint

At its annual Supplier Excellence Awards (SEA) event, Raytheon Company's Space and Airborne Systems (SAS) recognized RF front-end product maker and foundry services provider TriQuint Semiconductor Inc of Hillsboro, OR, USA with a four-star award for quality, delivery performance and customer satisfaction in relation to work on chipsets for phased array radar and other critical programs. TriQuint was one of 15 firms recognized and one of only two that received top, 4-star honors.

TriQuint makes ICs for defense and aerospace applications including communications satellites, phased array radar, guidance, control and related systems. Expertise in RF, microwave and millimeter-wave power and filter technologies, die-level devices, packaged products and integrated modules has made TriQuint a major supplier of system components to defense and aerospace contractors. It is also ranked as the world's largest GaAs foundry service and the defense industry's leading foundry provider, according to market research firm Strategy Analytics.

"We continually strive to offer our customers the industry's best power and filter devices through our top-rated foundry, supported by our ISO/AS9100 Approved Quality System," said Dr Gailon Brehm, TriQuint's Military Products marketing director, who received the award along with TriQuint VP Tom Cordner. "Raytheon SAS has been an exemplary customer. We will continually pursue the highest standards, providing Raytheon with products that meet their standards of excellence," Brehm added.

www.triquint.com

Hittite's growth sustained by Asia and Eastern Europe telecom companies

For Q3/2008, Hittite Microwave Corp of Chelmsford, MA, USA, which designs and supplies RF, microwave and millimeter-wave ICs, modules and subsystems, has reported revenue of $45.5m: $18.1m (40%) from the USA (7% year-on-year growth) and $27.4m (60%) from outside the USA (19% growth).

Total revenue is up 14% on $39.9m a year ago and up 1.1% on Q2's $45m due to increased international orders and continued growth from the launch of new products.

"Our diverse product lines continue to penetrate and gain market share," says chairman & CEO Stephen Daly. Hittite launched 30 new products in Q3 (bringing the standard product portfolio to 701). These included 11 mixers, 11 high-speed logic, three VGAs, two VCOs, and one each in the mixer, modulator, and frequency-divider product lines. Since the start of 2006, Hittite has launched eight product lines and over 300 products: 91 in 2006; 101 plus 51 products from Velocium in 2007; and 68 so far this year. "These products address many markets and are just getting started," Daly adds. "It typically takes 1–3 years for our products to ramp to meaningful revenue."

Revenue distribution across Hittite's target eight markets was slightly more concentrated than in 2007 and Q2/2008 due to strong sequential growth in three markets (cellular infrastructure, microwave and millimeter-wave communications, and military) which accounted for about 76% of revenue. The automotive, broadband, fiber-optic, space, and test & measurement markets accounted for the rest.

In particular, demand for high-data-rate communications services is driving customers to either upgrade or deploy new equipment. Demand in microwave and cellular market segments was driven by telecom infrastructure deployments across Asia and Eastern Europe. Demand in the military market was driven by US programs. However, a notable trend was a slowdown in broadband business, partly due to Hittite's position changing at certain high-volume accounts as a result of platform changeovers.

Gross margin was 72.5%, up from 71% a year ago and 70.8% in Q2. Net income was a better-than-expected $13.7m, up on $13.5m in Q2 and level with a year ago.

Capital spending of $1.2m focused on microwave test & measurement equipment for engineering and production tooling. In particular, Hittite is expanding R&D staffing in its four design centers and continuing to invest in design tools and equipment. R&D spending rose $542,000 on Q2.

Hittite ascribes its continued growth to the diversity in its product portfolio, the markets that it serves, and its customer base (of over 2500) as well as efforts over the last three years to move into global markets. The firm expects international revenue growth to continue to outpace domestic growth in future.

Revenue growth was 31%, 61% and 20% in the past three years, and 17.7% in the year-to-date. For Q4, Hittite expects revenue of $45–46m (up 8% year-on-year) and net income of $13–13.5m. In particular, it expects the slowdown in broadband business to continue.

"The recent slowdown in our growth is not an indictor that we are lacking opportunities," says Daly. "While we are impacted by our existing customers' current growth rates, we stand before a multi-billion dollar market and we have more resource than ever before," he adds. "Our ability to capture market share depends on our ability to execute on successful MMIC design and product launch and design-win activities... Our strategy of launching innovative products and product lines is intended to keep Hittite's growth rate ahead of the markets we serve."

www.hittite.com

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AWR and UMS launch GaAs MMIC design incentive program

Applied Wave Research Inc (AWR) of El Segundo, CA, USA and United Monolithic Semiconductors (UMS) of Orsay, France have introduced 'Try the Power', an incentive program providing new customers with the opportunity to bring GaAs monolithic microwave integrated circuit (MMIC) design prototypes to market quickly and easily using AWR's Microwave Office based electronic design automation (EDA) software and the UMS PPH25X foundry process design kit (PDK).

The program runs from 15 November 2008 to 31 May 2009 (chips delivered), and includes free PDKs, a free 90-day lease for AWR's flagship high-frequency design software, Microwave Office design suite, and a reduced-rate prototype development quickturn (PDQ) shared-wafer foundry run using the UMS PPH25X process.

UMS has developed and qualified the PPH25X pHEMT process for high-frequency and high-power designs. It features a very high breakdown voltage, providing high power density up to 1W/mm of gate periphery. Optimized small via-hole definitions through the 70µm substrate thickness can be directly connected to the sources of the transistors, reducing parasitics and simplifying wideband amplifier designs, says UMS.

Small via-hole definitions through the 70µm substrate thickness can be directly connected to the sources of the transistors

The high performance of the PPH25X process (with a 45GHz f_T) suits use for power design at very high frequencies. The process is fully qualified and open in foundry mode.

For high-frequency design, AWR's Microwave Office software offers: linear and non-linear circuit simulators, electromagnetic (EM) analysis tools, integrated schematic and layout, statistical design capabilities, and parametric cell libraries with built-in design-rule check (DRC).

The limited-time offer is available for start-up firms and new customers of UMS and AWR.

www.ums-gaas.com
http://web.awrcorp.com

Kopin reports record revenue, despite III-Vs weakening

For third-quarter 2008, Kopin Corp of Taunton, MA, USA, which makes III-V HBT epiwafers and Cyber-Display LCDs, has reported record revenue of $30.7m, up 19% on $25.8m last quarter. "Despite a challenging macro-economic climate, we reported the highest quarterly revenue in our history," says president and CEO Dr John C.C. Fan.

However, growth came from display revenue of $18.9m (up 39% on $13.6m), offsetting III-V revenue falling slightly by 3% from $12.2m to $11.8m (though up 6% from $11.1m a year ago).

Revenue from display products for military applications more than doubled year-on-year, reflecting Kopin's participation in many US military programs.

"Our III-V product line remained a steady contributor during the quarter," says Fan. "Among our wireless circuit partners, we have seen a continued migration toward InGaP (indium gallium phosphide) power amplifiers to handle the performance demands of today's wireless handsets and mobile devices." Kopin introduced its first InGaP HBTs a decade ago. "Our deep expertise only solidifies our competitive advantage as the market transitions toward this technology," Fan reckons.

Due mainly to Kopin's strategy of focusing on military products and other applications where its display technology is a differentiator, gross margin has risen by more than 1600 basis points over the last year to 33.8%. Operating income was $3.2m, compared to a loss of $677,000 a year ago.

Despite a loss of $2m from the sale of the firm Kenet (in which Kopin had a stake) and an impairment charge of $0.5m on corporate debt securities, net income was $1.5m (boosted by $1.2m of gains related to foreign currency fluctuations), compared with a net loss of $1.7m last quarter. As of 27 September, Kopin had no long-term debt, and cash and marketable securities totaled $92m.

"We begin the fourth quarter in a strong operational and financial position. While the macro-economic environment is unsettled, we believe our strong liquidity and our experience in managing through previous periods of financial contraction will enable us to succeed," says Fan. "With our technical skill, differentiated products, manufacturing expertise and emphasis on higher-value applications, we are focused on continuing to improve our product mix, generate higher margins and drive revenue growth," he concludes.

For full-year 2008, Kopin remains on track to achieve its revenue guidance of $105–115m.

www.kopin.com

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RFMD signs $1.4m DoD contract to develop GaN technology and high-power RF solutions

At its fourth annual Analyst Day in New York, RF Micro Devices Inc of Greensboro, NC, USA said that it has signed a 12-month $1.4m contract with the US Department of Defense (DoD) to develop GaN technology and high-power RF solutions.

The contract represents an extension to previous DoD contracts and is in support of RFMD's ongoing GaN RF power technology project (targeting military and civilian radar systems and multi-band radios requiring wideband, high-efficiency amplifiers up to 500W), with the aim of extending the cut-off frequency of RFMD's GaN process up to 90GHz.

"We are fortunate to have future program support to expand the frequency capability of our GaN process into millimeter-wave frequencies, enabling us to target new radar, electronic warfare (EW) and satcom radio applications," says Jeff Shealy, VP & general manager of RFMD's Aerospace & Defense business unit.

The program's goals include reliability verification, passive element development and technology qualification of a manufacturable 48V GaN RF power process for amplifiers and switches. In addition, the current program supports the demonstration of wideband, high power GaN MMIC amplifier and switch circuits targeting L-, S- and C-band applications.

RFMD says that it has recorded contract revenue in excess of $1m over the last six months, and expects to receive additional DoD contract awards in 2009. Beyond the current program, RFMD has $5m in contract backlog to expand the capabilities of its GaN RF technology over the next 18 months and has received nearly $10m in DoD contract funding since 2004.

"Our recent award and strong DoD contract funding backlog highlight our growing presence in the aerospace & defense marketplace," says Bob Van Buskirk, president of RFMD's Multi-Market Products Group. "RFMD anticipates its efforts in GaN RF power technology development will support multiple advances across a range of applications, including aerospace & defense, wireless infrastructure and CATV infrastructure."

Compared to currently available high-power RF technologies, RFMD expects its GaN technology to deliver configurable wideband, high-power amplifiers with improved efficiency and ruggedness. Configurable wideband amplifiers enable radio architecture convergence with reduced bill of materials (BOM) complexity, while improved ruggedness adds further protection in challenging operating environments, says the firm.

As RFMD is the world's largest GaAs manufacturer (with a high-volume supply chain) and produces the GaN internally, the firm expects to offer it at very competitive pricing. The addressable market for GaN RF power technology is expected to be about $172m by 2012, driven by aerospace & defense, 3G-BTS, WiMAX infrastructure and cable TV applications, although GaN for WiMAX will depend strongly on LTE (long-term evolution) market penetration and the related frequency in use.

RFMD has also announced that its GaN process technology, fabricated in its high-volume commercial wafer fab, has been released for production designs for a broad range of aerospace & defense and commercial applications.

www.rfmd.com/aerospacedefense

GeneSiC awarded $1.5m in Department of Energy grants

The US Department of Energy (DoE) has awarded GeneSiC Semiconductor Inc of Dulles, VA, USA two separate grants totaling $1.5m for the development of high-voltage silicon carbide devices: a $750,000 Phase II Small Business Innovation Research (SBIR) grant for the development of fast, ultra-high-voltage SiC bipolar devices, and a $750,000 Phase II Small Business Technology Transfer (STTR) grant for the development of optically gated high-power switches.

The devices will serve as enablers for wind- and solar-power integration with the USA's electricity grid. SiC can handle 10 times the voltage and 100 times the current that silicon can, suiting high-power applications such as wind and solar installations and electrical-grid control systems.

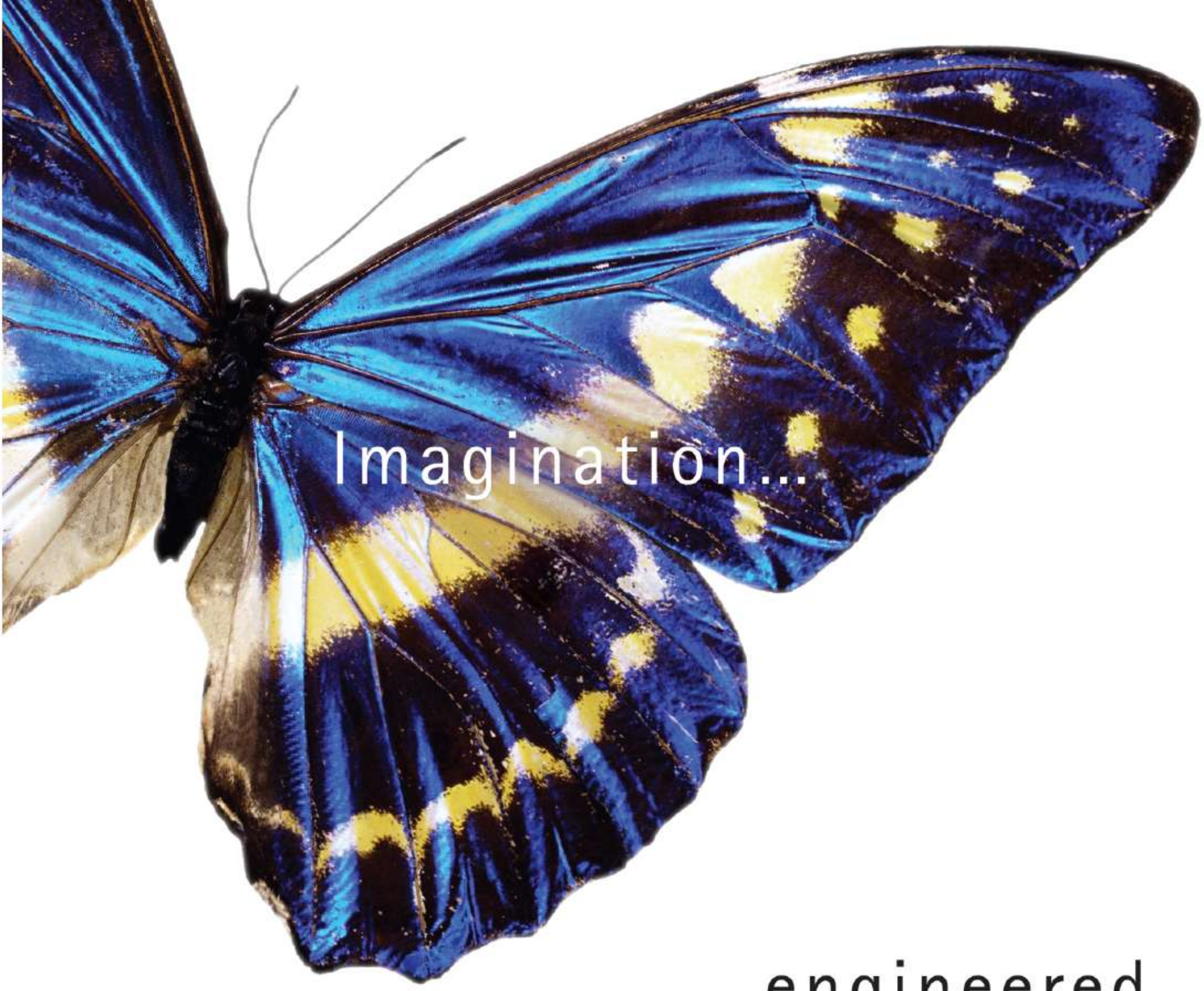
Specifically, the two awards are for:

- Development of high-frequency, multi-kilovolt SiC gate-turn-off (GTO) power devices. Government and commercial applications include power-management and conditioning systems for ships, the utility industry, and medical imaging.
- Design and fabrication of optically gated high-voltage, high-power SiC switching devices. Using fiber-optics to switch power suits environments plagued by electro-magnetic interference (EMI), as well as applications that require ultra-high-voltages.

The SiC devices that GeneSiC is developing serve a variety of energy storage, power grid, and military applications, which are receiving attention due to the increasing focus on more efficient and cost-effective energy-management solutions.

"These awards demonstrate the DOE's confidence in GeneSiC's capabilities, as well as its commitment to alternative energy solutions," says president Ranbir Singh. "An integrated, efficient power grid is critical to the nation's energy future—and the SiC devices we're developing are critical for overcoming the inefficiencies of conventional silicon."

www.genesicsemi.com



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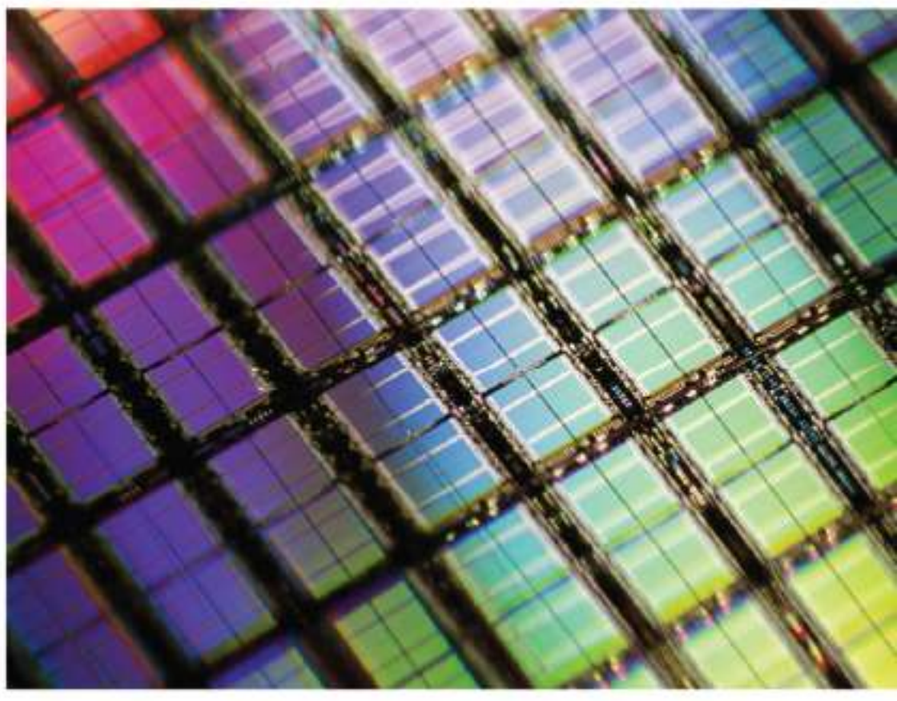

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Record-performance 5GHz-bandwidth hybrid amplifier

At the 2008 IEEE Compound Semiconductor IC Symposium (CSICS) in Monterey, CA, USA in October, Japan's Fujitsu Laboratories Ltd detailed its development of a power amplifier based on gallium nitride high-electron-mobility transistors (HEMTs) which, as a hybrid amplifier (with the transistor and capacitor each mounted on separate package substrates), has record output performance in terms of power and efficiency at C- to X-band RF bandwidths above 5GHz.

Fujitsu says that the technology opens up the potential for higher performance and functionality in broadband and radar communication systems, in particular for airplane radar systems and other instruments that use multiple frequencies, which could be accommodated by a single amplifier. Also, compared with conventional power amplifiers that use GaAs, the new ultra-wideband (UWB) GaN HEMT-based amplifier features higher efficiency (the proportion of direct-current input power converted to high-frequency output power), enabling a reduction in the size of cooling equipment (which should result in smaller and lighter power amplifiers).

Fujitsu says that, to expand radar detection ranges and the distance that radio waves in wireless communications can travel, it is necessary to increase the output power of transmitters. In addition, to increase transmission capacities and heighten the detection performance of radar that detects multiple targets, it is necessary to expand the bandwidth of transmitters and enable them to handle multiple channels. Airplane radar systems need to use two different types of transmitters so that they can switch back and forth between the C-band (4–8GHz, which is relatively impervious to the effect of atmospheric precipitation) and the X-band (8–12GHz, which enables high-resolution measurement). If a transmitter could handle ultra-wideband frequencies spanning from the C-band to the X-band, then just one transmitter would suffice, allowing systems to be more compact.

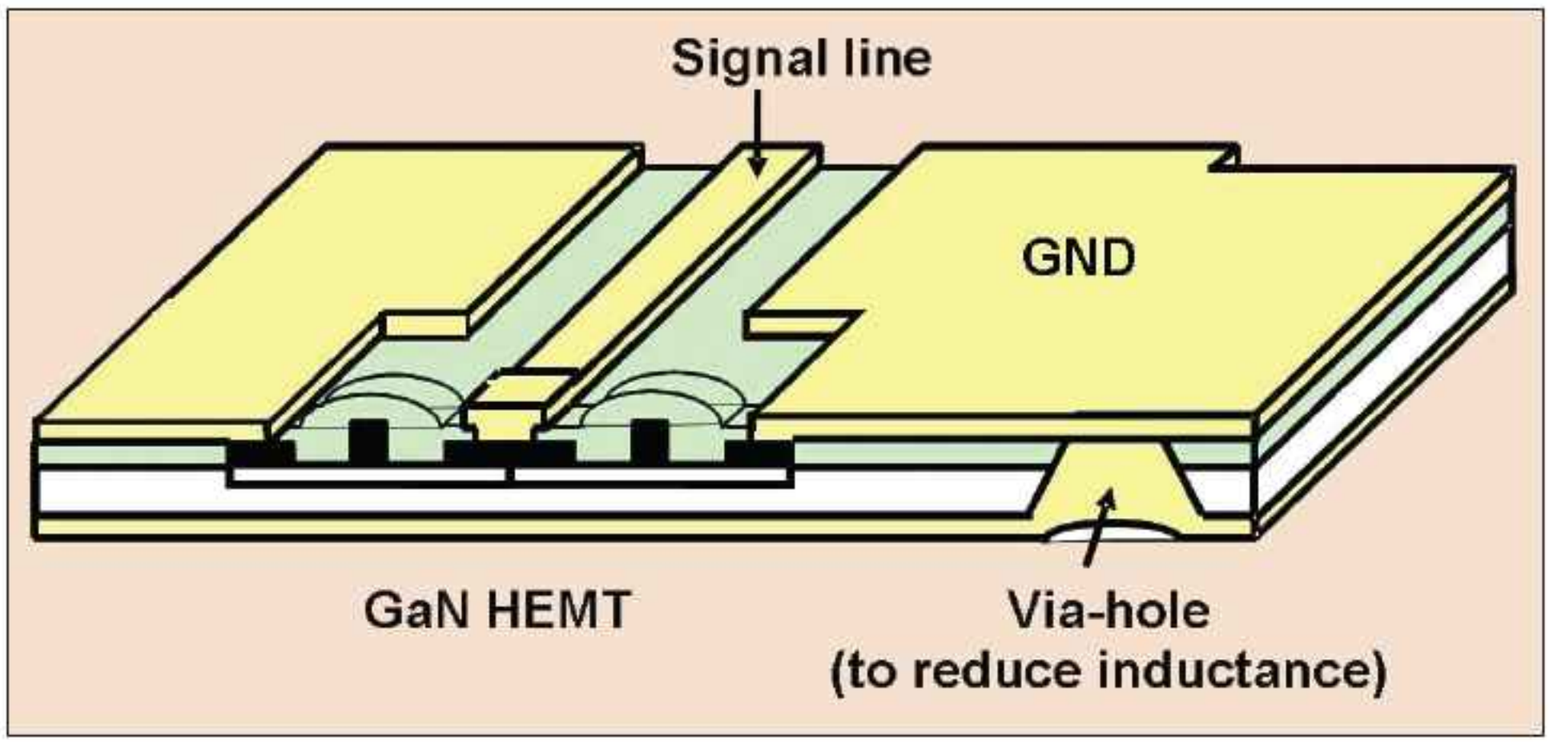

Figure 1. Diagram of GaN HEMT chip with via-holes.

Conventionally, wideband high-output amplifiers have used GaAs transistors. But, to generate sufficient transmission output, the output of many GaAs transistors needs to be combined, reducing efficiency due to losses in the matching circuits (which equalize an output circuit's load with the receiving-side circuit's input load, to maximize the power generated in an electrical signal transmission path). So, recent years have seen a surge in efforts to develop GaN-based HEMT amplifiers, which have a larger dielectric breakdown field and the potential to generate higher output levels.

Monolithic microwave integrated circuits (MMICs) — with a transistor, capacitor, resistor, and circuit interconnects mounted on the same substrate — enable wideband characteristics at high frequencies such as the C- and X-band ranges. However, due to the problems of using GaAs transistors, MMICs using GaAs have been unable to deliver sufficient levels of output and efficiency.

On the other hand, in trying to apply MMIC technology to GaN HEMTs with high operating voltages, the breakdown voltage of the chip capacitor has been insufficient. By using a hybrid integrated circuit in which the transistor and capacitor are mounted separately instead of integrated onto the same MMIC die, the impedance problem is eliminated because a high-breakdown-voltage capacitor can be used. However, as wires used in the signal line connections or ground connections reduce the amplification factor of high-frequency signals (increasing frequency variance), up to now it has been difficult to generate high efficiency in a wide bandwidth.

Fujitsu says that its C- to X-band hybrid GaN HEMT power amplifier resolves these issues. Key features of the technology include the following:

- Although wires used in ground connections reduce the amplification factor of high-frequency signals used in the C- to X-band range, in the new hybrid circuit a transistor with via holes that connect the GaN HEMT chip's surface electrode with the bottom electrode (Figure 1) is used, eliminating the need for ground connection wires

and suppressing the reduction in the amplification factor of high-frequency signals.

● To suppress the frequency variance caused by wires used in the signal line connection, a UWB matching circuit was developed. Also, by using a high-breakdown-voltage capacitor in the matching circuit, high output power was achieved at high operating voltages.

Fujitsu says that these technologies enabled the generation of both high output power and high efficiency at high frequencies across wide bandwidth. In addition, despite being a hybrid power amplifier, the new amplifier is compact, measuring just 6.0mm x 6.6mm (Figure 2).

The new UWB hybrid C- to X-band power amplifier achieved output of 6.5W and efficiency of 40% at a frequency of 7GHz, and output of 4.1W and efficiency of 26% at 12GHz. Fujitsu claims that this significantly exceeds previously reported performance for UWB GaN-based high-output hybrid amplifiers (see Figure 3).

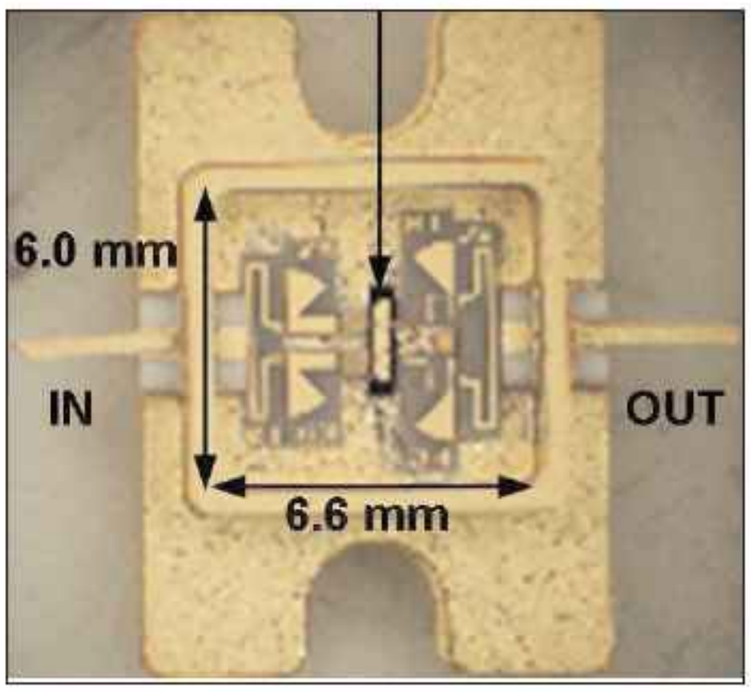

Figure 2. Newly developed C- to X-band power amplifier.

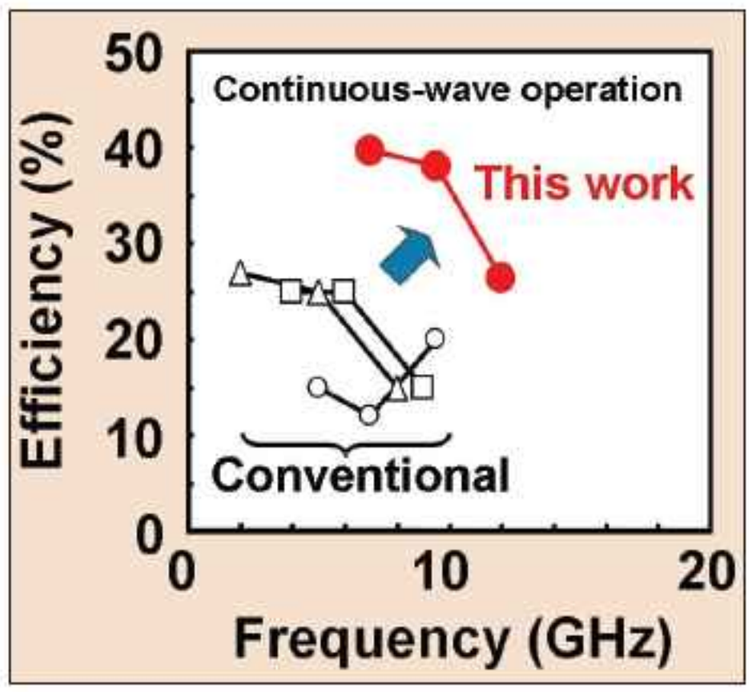

Figure 3. Efficiency comparison of UWB GaN-hybrid C- to X-band PAs.

The firm reckons that the technology enables transmitters to handle multiple channels and allows the use of multiple frequencies with differing characteristics, boosting performance and functionality in systems for applications such as broadband communications and radar. The technology can also be used in measuring instruments, for which output at high frequencies had been insufficient, in order to measure the performance of amplifiers used in such systems. Moreover, because the new GaN-HEMT-based amplifiers are more efficient than amplifiers using GaAs, it should be possible to reduce the size and weight of the box housing the amplifier and cooling system.

Fujitsu plans to apply the technology widely in areas requiring high-output broadband performance, such as wireless communications equipment and radar systems.

http://jp.fujitsu.com/group/labs/en

IN BRIEF

FSI receives repeat litho system order from GaAs foundry

Surface conditioning and microlithography equipment maker FSI International Inc of Chaska, MN, USA has received a repeat order for a Polaris microlithography system from what it describes as a 'leading gallium arsenide device foundry'. FSI claims that it has 15 years of experience with GaAs substrates.

"We are experiencing increased Polaris system interest from the rapidly growing broadband wireless and wireline communications component manufacturers," says chairman & CEO Don Mitchell. "Our Polaris product's flexibility allows our customers to process gallium arsenide and gallium nitride substrates in multiple sizes within the same system with no hardware or software changes," he adds. "The ability to process multiple wafer sizes simultaneously provides a greater degree of flexibility without compromising process performance."

With orders from broadband wireless and wireline communications device makers expected to increase, FSI is placing an emphasis on continued expansion into what it calls a key market.

Polaris systems provide adhesion and resist coating, as well as baking, chilling and developing processes for wafer sizes of 100–300mm in diameter. With a large installed base, Polaris systems already serve many applications and industries, including thin-film head, medical and GaAs device manufacturing. In addition, the firm's support services provide product and process enhancements to extend the life of installed FSI equipment, enabling users to realize a higher return on capital investment.

www.fsi-intl.com

IQE formally opens new Singapore plant

Epiwafer foundry and substrate maker IQE plc of Cardiff, Wales, UK has formally opened its new facility in Singapore, following the relocation of its Asia manufacturing facility.

The facility was opened by His Excellency Paul Madden, British High Commissioner in Singapore, along with IQE's CEO Dr Drew Nelson and Lim Swee Nian, executive director of the Singapore Economic Development Board, in the presence of almost 200 guests (customers, suppliers, and contractors).

The firm says that the new plant will continue to produce wafers for wireless applications such as mobile phones and WiFi devices but will also provide capacity for new products such as materials for advanced electronics and high-efficiency solar cells (photovoltaics).

Over the last year, IQE's subsidiary MBE Technology (acquired in second-half 2006) has been relocating its manufacturing operations from a site at the Singapore Science Park that it had occupied since its formation in 1993, to the new facility within Singapore's newest industrial development area in Tampines.

The purpose-built, 8500m^2 facility houses over 2000m^2 of specialized cleanroom and will allow for significant future expansion of manufacturing capacity in the Far East.

In addition to relocating manufacturing tools from the original Singapore site, equipment has also been transferred from other parts of the group, particularly from the sister operation in Bethlehem, PA, USA. The firm says that the relocation of manufacturing tools was carried out in a way that has caused minimal disruption to existing production capacity.

"The opening of our new plant here today is the culmination of a major exercise to move plant and equipment from one site to another

MBE Technology's managing director L G Yeap (third from left) and, from fifth from left, High Commissioner Paul Madden, then IQE plc's CEO Drew Nelson, and Singapore EDB's David Chan and Fong Pin Fen.

in a way that was seamless in terms of continuity of supply of products to our customers," said L G Yeap, managing director and founder of MBE Technology. "It is with great thanks to the professionalism, dedication and support of our key customers, suppliers and contractors and the experience and support of agencies such as the Singapore Economic Development Board (EDB) that the whole process has been completed on time and with minimal impact on our production processes," he added.

"Whilst it is unclear at this point what the impact of the global financial crisis will have on the wireless communications industry, the long-term demand drivers for the industry are as strong as ever and the demand for wireless products appears set to grow rapidly over the coming years, and this new facility provides us with the capability to add capacity as and when required," comments Nelson.

"This year also marks the 20th anniversary of the IQE Group, which currently operates manufacturing facilities on a global basis: in the UK; the USA; and, of course, the new facility here in Singapore."

www.iqep.com

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IN BRIEF

Ohio State orders reactor for PVs

In Q3/2008, Aixtron received an order from Ohio State University (OSU) for a Close Coupled Showerhead MOCVD reactor in 3x2"-wafer configuration for delivery at the beginning of 2009 to OSU's Institute for Materials Research (IMR) and the Wright Center for Photovoltaics Innovation and Commercialization (PVIC), a state-funded center promoting university/industry research collaboration and commercialization.

The system will be a centerpiece of the new PV research center, says professor Steven A. Ringel, IMR director. Its installation in OSU's Nanotechnology West Laboratory alongside a set of complementary processing, fabrication and testing facilities will support comprehensive research in all areas of advanced semiconductor science and technology, he adds.

www.aixtron.com

Thin-film metrology tools for MEMS & PVs

At October's Semicon Europa 2008 in Stuttgart, Germany, PANalytical of Almelo, The Netherlands gave a European launch for an updated version of its SuperQ 4.0 Thin Film package, for use on the PW2830 wavelength-dispersive x-ray fluorescence spectrometry (XRF) system and the Semyos micro-XRF wafer analyzer. The proven software for thickness, composition and uniformity analysis of thin films now includes enhanced Fundamental Parameter Software (FP Multi). PANalytical claims best-in-class performance, with analysis of up to 16 complex layers and the facility to measure and track wafers through deposition steps to stack completion.

www.panalytical.com/semi

AXT's sales fall due to requalifications and post-Olympics restrictions

For third-quarter 2008, substrate maker AXT Inc of Fremont, CA, USA has reported revenue of $17.9m, up from $14.5m a year ago but down from $19.9m last quarter (and down on July's guidance of $20.1–20.5m).

The drop was due mainly to: (a) an overall market slowdown and lower-than-expected demand from customer orders, which also resulted in lower production levels; (b) continuing efforts to resolve product specification issues with select customers from last quarter; (c) the temporary transportation restrictions on raw materials in China being extended unexpectedly through the Beijing Paralympics to the end of September.

Consequently, raw materials sales were $3m (mainly 99.99%-pure gallium), down from $4.9m last quarter and $3.6m a year ago.

Indium phosphide substrate revenue was $484,000, down from $500,000 last quarter. Germanium substrate revenue was $795,000, down from $1.4m last quarter. This was partly due to requalifying wafers with one customer that has brought a new reactor online.

Also, AXT's engineering team has been working to resolve product specification issues with a GaAs customer to develop a product that meets its requirements.

Nevertheless, total GaAs substrate revenue has risen from $9.9m a year ago and $13.1m last quarter to $13.6m (56% semi-insulating; 44% semiconducting). While 2–3" sales fell by $600,000 and 6" sales were steady at $5.5m, 4" semi-insulating sales grew strongly by $1m.

However, GaAs sales rose less than expected due to the economy-driven downturn in consumer spending causing shifts in market share among AXT's client base. But, chairman & CEO Phil Yin says that this is creating opportunities to penetrate accounts with clients that have done little or no business with AXT for some time as they seek ways to handle the increasing capacity requirement. In particular, 4" sales rose due to shipments to customers that had represented only a small proportion of business last quarter.

Overall gross margin was 25.4%, down from last quarter's 32.3%, due partly to the lower product mix in raw materials. Loss from operations was $926,000, compared with income of $2.3m last quarter.

"Despite the continuing margin pressure, our GaAs and raw materials businesses have been solid," says Yin. "While the volatile business and financial markets are prompting us to continue to take a conservative approach we remain optimistic about business in the quarters to come."

For Q4/2008, AXT expects revenue to rise to $21.4–21.9m, including raw materials revenues rebounding to $6.5m due to Olympics-induced orders delayed from Q3, a rise of $400,000 for Ge, and a modest rise of $0.5–1m for GaAs (via returning 4" semi-insulating GaAs customers). Full-year revenue is expected to be $79m, up 35% on 2007. Indeed, despite the lower-than-expected growth for GaAs in Q3, in anticipation of rising demand AXT's expansion of its 6" GaAs capacity in China is ahead of schedule, after capital expenditure of $2.9m in Q3 (taking full-year CapEx to $7–8m, to be followed by similar CapEx in 2009).

Regarding Ge, after completing substrate qualification with a large European concentrator photovoltaic firm, volume shipments should begin in Q1/2009 for satellite applications; qualification is ongoing for terrestrial applications. Meanwhile three other qualifications are ongoing with European PV firms, offering prospects for long-term growth.

"Positive industry trends, coupled with our competitive manufacturing and cost advantages, give us confidence in our ability to continue to drive future business in 2009," says Yin.

www.axt.com

Source Materials

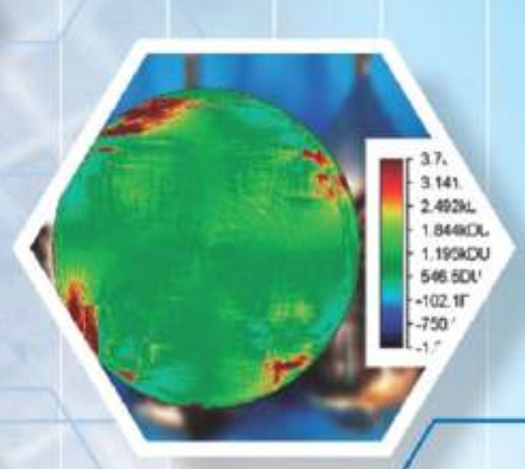
LPE

VPE

InAs

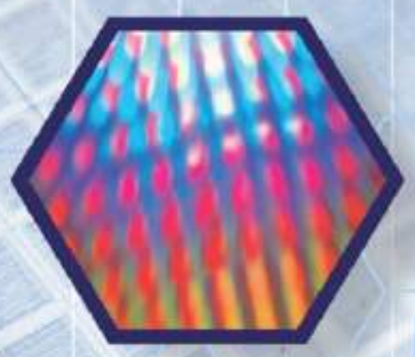
VCSEL

InSb



MOCVD

PIN



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Aixtron banks on long-term LED growth during order dip

Deposition equipment maker Aixtron of Aachen, Germany has reported revenue of €63.9m for Q3/2008, up 24% on €51.7m a year ago but down slightly on Q2's €65.6m.

Gross margin has risen from 39% last quarter to 42%. Net profit was €5.5m, down on Q2's €7.4m. Cash and cash equivalents were €77.2m (up 44% on €53.7m a year ago), and the firm recorded no bank borrowings.

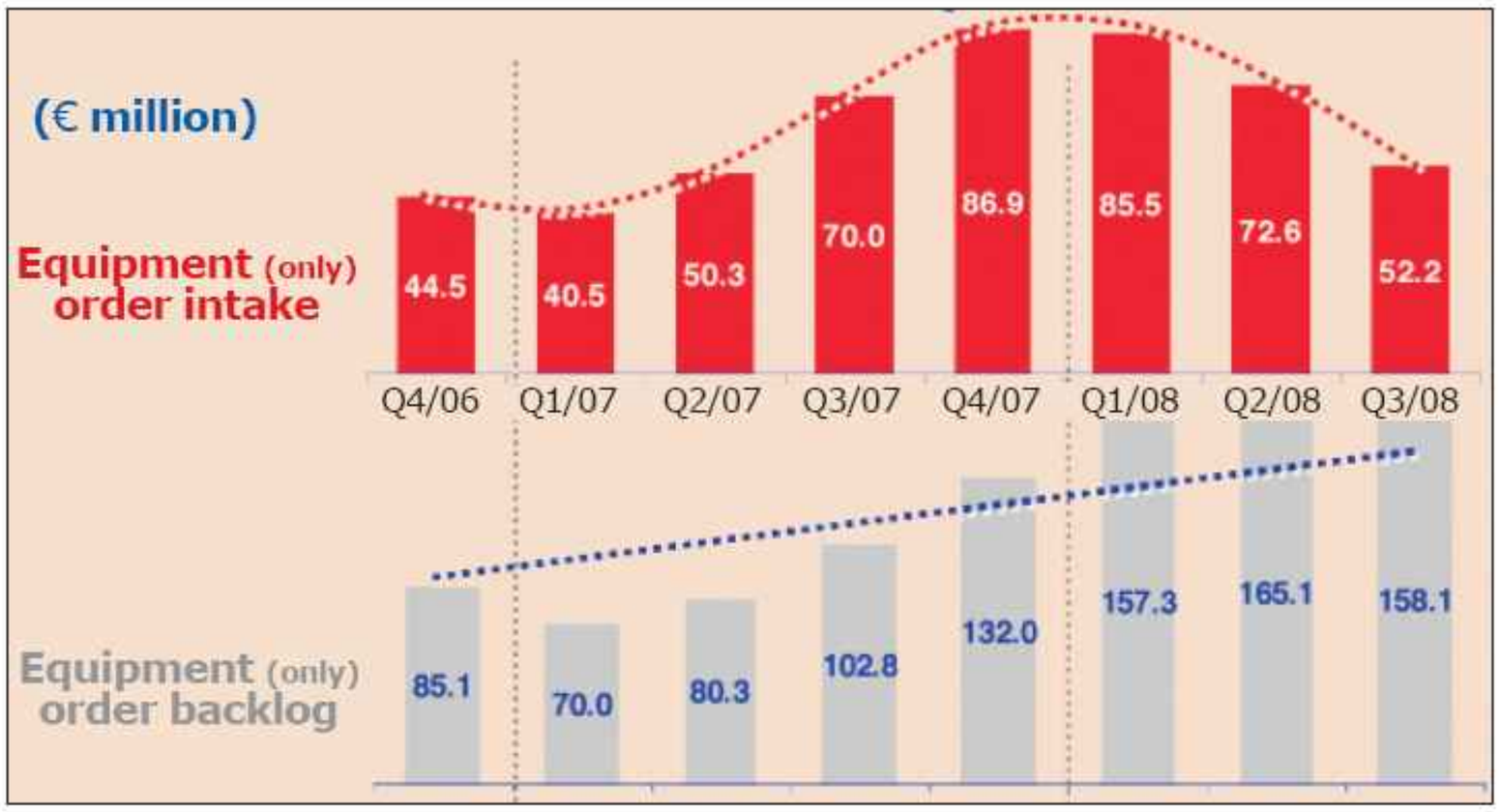
For the first nine months of 2008, revenue was €192.1m, up 20% on €160.7 a year ago, despite a weaker average US-dollar exchange rate and the effects of the growing credit crisis in Q3.

Continued weakness in DRAM and NAND flash memory markets meant that silicon semiconductor equipment contributed just 5% of revenue (€10.2m, down 70% from €33.8m, or 21% of revenue, a year ago), in line with market conditions, says Aixtron.

Growth has been driven largely by strong sales of higher-margin common-platform-based compound semiconductor MOCVD deposition equipment for the LED industry, particularly for backlighting products for liquid crystal display (e.g. in notebook PCs) and commercial display applications. Compound semiconductor equipment (including OVPD and SiC) contributed 84% of revenue (€160.9m, up 50% year-on-year).

Correspondingly, by region, Asia accounted for €169.7m (88% of revenue), Europe €11m (6%), and the USA €11.4m (6%).

Equipment order intake was €210.2m, up 31% on €160.8m a year ago. Compound semiconductor equipment contributed 94% (€198.4m, up 53% from €129.8m, or 81% of orders, a year ago). Silicon semiconductor equipment has fallen from 19% of orders to 6%.



Aixtron's order intake and backlog development over the last 24 months.

However, in Q3/2008 in particular, equipment order intake fell (by 28% on €72.5m in Q2). This is in line with the expected 'digestion' phase of the current investment cycle of LED capacity expansion for backlighting applications.

Equipment order backlog has hence fallen from Q2's €165.1m to €158.1m (though still up 54% on €102.8m a year ago). Of this, 96% is compound semiconductor equipment (versus just 4% for silicon semiconductor equipment, compared to 7% a year ago).

"Our order intake recognition policy remains conservative, and consequently we have not recorded any order cancellations to date," says president & CEO Paul Hyland.

Aixtron has reiterated its full-year guidance for revenue of €270m (actual revenue of €192m from the first nine months of 2008, plus €71m from the €158m order backlog and €7m in assumed spares/non-system revenue for Q4).

"In the increasingly difficult macroeconomic environment, our strategic focus and financial and operational flexibility are crucially important assets that we are striving to improve further," says Hyland.

"Our 'pure-play' market-led developments and the flexible manufacturing strategies are exactly the focused approach required in the volatile market environment we are having to contend with," he adds.

Aixtron hence continued to increase capital expenditure in the first nine months of 2008, almost tripling from €3.3m a year ago to €9.2m (including €8.3m for technical equipment such as testing and laboratory equipment).

Also, while Aixtron expects lower order intake in the short term, it remains optimistic about the evident medium- to long-term trends to increasing adoption of LED technologies in a wide range of applications.

"We have worked very hard in recent years not only to raise the competitiveness of our products, but also to enhance our manufacturing processes," says Hyland. Over the next six months, Aixtron plans to continue to invest in lab equipment and further implementation of a group-wide SAP Enterprise Software System. "We are pursuing very real opportunities to further improve our manufacturing profitability in the coming year," Hyland concludes.

www.aixtron.com

Veeco investing in MOCVD R&D despite LED firms' overcapacity

For Q3/2008, Veeco Instruments Inc of Plainview, NY, USA has reported revenue of $115.7m, up 18% on $98m a year ago but up only slightly from $114.4m last quarter.

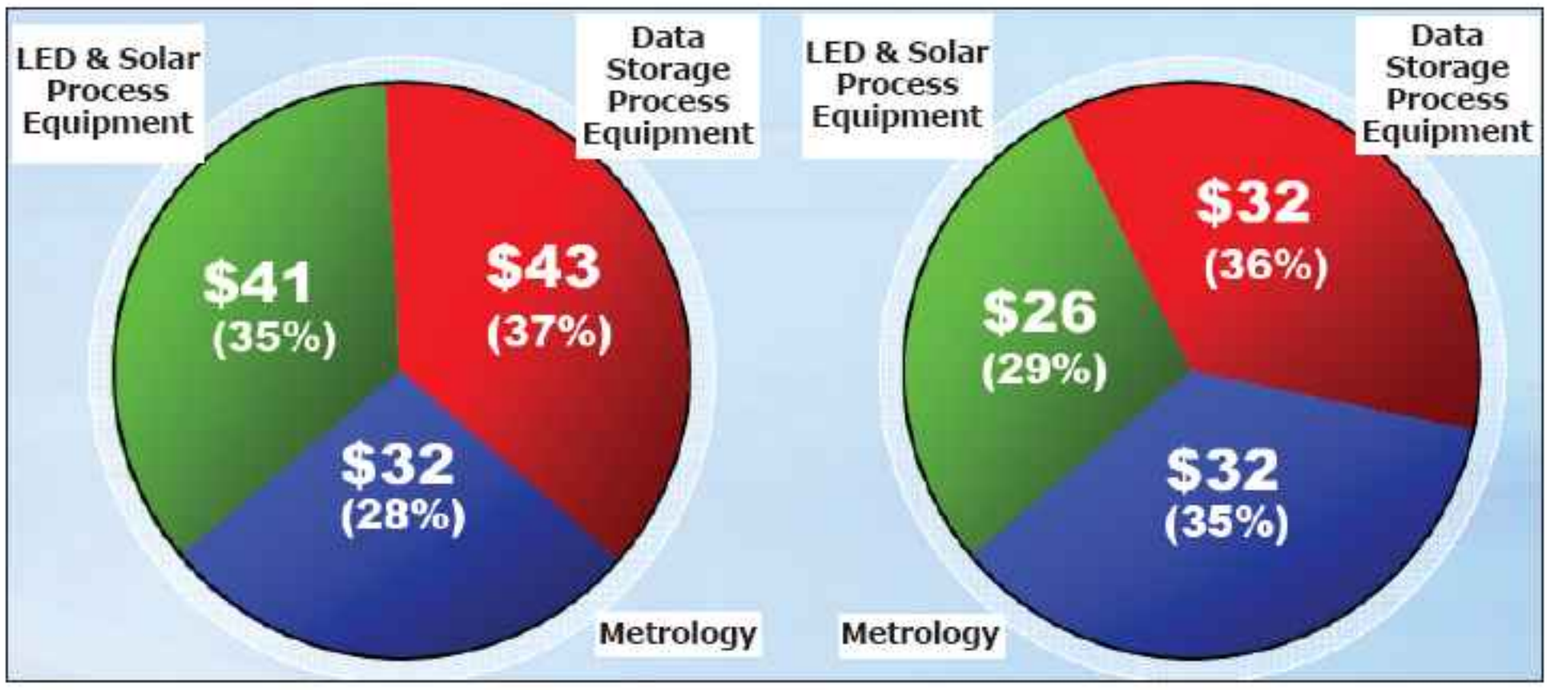
Net loss was $1.7m, compared to net income of $4.2m last quarter.

In the first nine months of 2008, revenue for Veeco's LED & Solar Process Equipment segment (MOCVD, MBE and CIGS web-coating deposition tools and sources) was up 56% year-on-year to $128.2m (growing from 21% of total revenue in 2006 and 29% in 2007 to 39%, becoming Veeco's largest segment). Solar products (mainly MOCVD and thermal deposition sources) represented about 20% of the segment's revenue and orders.

For Q3/2008, Veeco's LED & Solar Process Equipment segment contributed just 35% of revenue ($41m, up 28% on $32m a year ago but down from $45.1m last quarter), the Data Storage Process Equipment segment 37% of revenue ($43m, flat on last quarter), and the Metrology segment 28% of revenue ($31.5m, down on $32.6m last quarter).

Orders were a less-than-expected $90.2m (well below guidance of $113–118m), down on $136.5m last quarter. By segment, Data Storage Process Equipment comprised 36% of orders ($32.3m, well down on $51.7m last quarter), Metrology as much as 35% ($32m, flat on $32.7m last quarter) and LED & Solar Process Equipment just 29% ($25.7m, less than half last quarter's $52.1m).

"While we anticipated a sequential bookings decline from the strong second quarter results, bookings were weaker than expected due to global economic conditions," says CEO John R. Peeler. "Veeco experienced the sharpest sequential order decline in MOCVD tools as the HB-LED industry [especially in Taiwan and China] digests the significant number of new tools purchased this past year," he adds. Due to the overcapacity of MOCVD reactors that has built up, customers are either delaying or foregoing capacity and technology purchases, with Veeco experiencing $9m of order push-outs from Taiwan and China, as well as some cancellations.



Veeco's revenues of $116m (left) and bookings of $90m (right) in Q3/2008.

For Q4/2008, Veeco expects revenue of $110–118m. Assuming the high-end of this guidance, despite the difficult economic conditions, for full-year 2008 Veeco expects revenue to be up more than 10% on 2007's $402m to $450m, with Metrology revenue down 13% from $150m to $130m but Data Storage Process Equipment revenue up 10% from $136m to $150m and LED & Solar Process Equipment revenue up 47% from $116m to $170m.

"While we have a healthy prospect list for new orders in the fourth quarter, it appears that the global economic climate and constrained financing environment may cause a broad slowdown in capital equipment purchases by our customers, with uncertainty as to the depth and duration of the downturn," cautions Peeler. "Due to this limited visibility, we are unable to give an accurate estimate of fourth quarter orders," he adds.

"We are taking corrective actions to lower our cost structure in preparation for what is likely to be a down revenue year in 2009 [driven by the LED shortfall, as well as the effect of macro-economic conditions on other markets]," continues Peeler. Job cuts are therefore being considered for the December 2008 quarter.

The goal is to keep Veeco EBITA profitable and cash-flow positive by lowering spending, while maintaining strategic investments in R&D during the current LED industry digestion period in order to build the LED & Solar product line.

In particular, in Q4/2008, a focus is to secure relationships with key customers (which include Global Solar Energy Inc of Tucson, AZ) for Veeco's Fast Flex web-coater platform and deposition sources for copper indium gallium diselenide (CIGS) PVs. Also, R&D for MOCVD is forecast to rise 36% year-on-year in 2008. "Our goal is to emerge from this cyclical pause with a better product lineup," Peeler states.

R&D for MOCVD is forecast to rise 36% year-on-year in 2008

www.veeco.com

IN BRIEF

Repeat order from LED maker for plasma etch system

Tegal has received another follow-on order for an additional 901ACS system from what it describes as a leading opto-semiconductor/LED manufacturer to support its capacity expansion for lighting and optical sensor device production. The system adds to the customer's existing installed base of Tegal 900ACS Series plasma etch systems in use for these applications.

"The Tegal 900ACS tool, with its single-wafer etch configuration, brings improved manufacturing precision to the task of fabricating LEDs," claims John Almerico, marketing director, Etch Products. Improved manufacturing precision translates to better process reproducibility, better manufacturing reproducibility, higher device yields, and lower operating costs for plasma etch applications, he adds.

The 901ACS is the latest in a series of capacitively coupled diode plasma etch systems produced by Tegal. Over 1500 systems in the 900 Series have been shipped to date.

The 900ACS Series is optimized for pad, zero layer, non-selective nitride, backside, and planarization etching, as well as for photoresist descum, oxide, nitride, poly, and compound materials applications for high-brightness LED, optoelectronics, thin-film head, and MEMS device fabrication.

Among other features, the 900ACS and 980ACS Series platforms incorporate a production-proven transport system that can robustly accommodate the 75–200mm round, square or rectangular substrates found in the opto, TFH, and MEMS markets.

Tegal cuts staffing 10%

For its fiscal second-quarter 2009 (to end-September 2008), plasma etch and deposition system maker Tegal Corp of Petaluma, CA, USA has reported revenue of just $2m (down 57% on $4.7m last quarter and 81% on $10.8m a year ago). The drop is attributed to the general economic weakness and slowdown in capital expenditures. Net loss was $2.5m, compared to just $0.8m last quarter and net income of $0.7m a year ago.

In September, Tegal acquired the deep reactive ion etch (DRIE) and plasma-enhanced chemical vapor deposition (PECVD) products (and related intellectual property) of Alcatel Micro Machining Systems (AMMS) from parent company Alcatel–Lucent for $1m plus about $4m in stock.

Correspondingly, during the quarter, cash reserves fell by $4.2m to $14m. However, order backlog has risen to $1.1m (currently $3.3m), including orders for DRIE systems.

"During the final month of the quarter we signed and closed our acquisition of the DRIE and LTPECVD products from Alcatel, and we are pleased with our progress to date on integrating the acquisition [which will eventually become part of Tegal's Petaluma operation]," says president & CEO Thomas Mika. "We recently announced two system orders for both cluster and stand-alone versions of the DRIE systems, one of which has already been installed at our customer," he adds. "These orders and a promising pipeline strengthen our belief in the long-term prospects for this business, and we will pursue this opportunity aggressively." The AMMS acquisition doubles the size of Tegal's market.

Nevertheless, during the quarter, Tegal initiated a 10% cut in staffing as well as other measures to reduce spending during the coming quarter, while preserving its ability to properly transition and support key growth opportunities, says Mika. Tegal had about 76 staff, including 55 in Petaluma. So far, eight production workers in Petaluma have lost their jobs, and several more positions may be cut.

"In the current tougher economic environment, we believe these steps, along with all of the profitability initiatives we have made in recent years, will help position the company to weather the storm and emerge as a stronger company," Mika adds. "We believe that, so long as the business environment does not significantly worsen, we can improve our results measurably on a sequential basis and we look forward to an improved financial forecast in the coming quarters."

● Tegal has appointed Peter Dijkstra as VP of global sales. During more than 25 years of experience of implementing global sales and service strategies in the semiconductor capital equipment market, Dijkstra held senior engineering positions at FOM-AMOLF and VG Instruments (both based in the Netherlands) and spent almost 20 years at Alcatel, holding positions as field engineer, sales support engineer, and sales manager. Most recently, he was director of worldwide sales & customer support for AMMS.

"His extensive international experience will continue to open up new opportunities in applications integral to Tegal such as telecommunication, automotive, aerospace, computer peripheral, biomedical industries and semiconductors," says Mika. "Peter brings extensive sales experience and a proven track record that will drive Tegal's competitive positioning and build on our recent success in this area."

"Tegal has put together an impressive array of products and innovative technology," comments Dijkstra. "I look forward to transforming Tegal's strategic sales plans and corporate vision into a profitable reality," he adds.

www.tegal.com

Lam using cash to invest in downturn

For the quarter ended 28 September, etch and wafer-cleaning equipment maker Lam Research Corp of Fremont, CA, USA has reported revenue of $440.4m, down 22% on $566.2m the prior quarter and down 36% on $685m a year ago. Shipments were $345m compared to $495m during the June quarter.

Operating expenses were cut from $160.7m in the June quarter to $149.9m, due mainly to savings in restructuring activities and a significant drop in all-employee variable compensation on lower profit levels.

Compared to 50.2% a year ago, gross margin has fallen further (though only slightly) from 41.6% in the June quarter to 41.4%, due mainly to reduced factory utilization levels consistent with reduced business activity. However, net income has taken a further big drop from $148.6m a year ago and $72.2m in the June quarter to just $8.9m.

On an ongoing basis (excluding restructuring costs and asset impairments from integrating wafer-cleaning equipment maker SEZ, net tax expense on accelerated tax planning strategy, and interest on the tax liability associated with the voluntary internal stock option review), net income was $32.6m, down from $75.8m for the June quarter. Nevertheless, cash flow from operating activities was about $43m.

Deferred revenue and deferred profit balances at the end of the quarter were $103.5m and $76.4m, respectively. The anticipated future revenue value of orders shipped to Japanese customers that was not recorded as deferred revenue was $41m.

"Results reflect the challenging environment for semiconductor equipment and the worsening conditions throughout the global economy," says president & CEO Steve Newberry. "While the length and volatility of this downturn are unpredictable at this time, we remain focused on our ability to deliver long-term sustainable growth while implementing appropriate actions consistent with our shorter-term financial objectives," he adds. "We are managing through the current weakness by making effective use of our strong balance sheet and significant cash position to make targeted, strategic investments while also prudently managing our operating expense structure. We believe these efforts will help us emerge from the present environment in a strong position to enable future revenue and profit growth."

Results reflect the challenging environment for semiconductor equipment and the worsening conditions throughout the global economy

● In September, Lam Research's board of directors authorized the repurchase of up to $250m of its common stock, either from the public market or in private purchases.

The program may be suspended or discontinued at any time, and is being funded using available cash. As of 29 June, Lam had $1.2bn in total cash and cash equivalents, short-term investments and restricted cash and investments, and 125 million shares outstanding.

The program reflects the confidence of both the management and the board in the firm's long-term growth prospects, said Newberry. "A stock buyback is an effective use of our available capital at this time, and provides the potential for increased returns to our shareholders over the long term."

www.lamresearch.com

JPSA appoints president

JPSA Laser of Manchester, NH, USA has appointed Charles E. Cuneo as its new president, replacing founder Jeffrey P. Sercel (who continues with the firm as chairman & chief technology officer).

Founded in 1994, JPSA Laser produces industrial systems based on ultraviolet, excimer, diode-pumped solid-state (DPSS) and ultrafast laser technology. Its micromachining systems, laser beam delivery systems, automation, and motion control systems are used in photovoltaic, semiconductor, and other industrial applications. JPSA also performs contract manufacturing, optical design consulting, applications development, and excimer laser refurbishment services.

Cuneo is a graduate of Yale University and earned an MBA from Harvard Business School where he concentrated on marketing and international business. Most recently, he was executive VP of ERG Global, a firm providing interim and temporary executive management resources to companies worldwide. Previously, he was president & chief operating officer for software company NeuMath Inc, and president & chief operating officer for Unitek Benchmark, a manufacturer of hermetic sealing systems for microelectronics (a subsidiary of laser manufacturer Unitek Miyachi Corp). Cuneo has also held management positions for other technology firms in the northeast USA, including Millipore Corp, ADE Corp, Credence Systems, and Teradyne Inc.

"His experience in growing technology companies and in building highly effective global businesses is exactly what we are looking for in a president as we continue the rapid growth of our businesses," says Sercel. JPSA recently expanded to new facilities.

www.jpsalaser.com

DuPont launches seals for thermal processes and PV manufacturing

At October's SEMICON Europa 2008 in Stuttgart, Germany, DuPont Performance Elastomers (DPE) of Wilmington, DE, USA launched Kalrez 8900 perfluoroelastomer parts for thermal processes. The new parts demonstrate longer seal life in high-temperature semiconductor manufacturing processes and help to cut downtime and cost of ownership, the firm claims.

For static and dynamic sealing applications in thermal processes such as oxidation, diffusion furnace, metal chemical vapor deposition (CVD), atomic layer deposition (ALD) and low-pressure CVD (LPCVD), Kalrez 8900 parts offer performance exceeding typical industry maintenance standards, allowing greater equipment uptime, claims DPE.

The parts provide thermal stability with a maximum continuous service temperature of 325°C, low outgassing properties, and good response to temperature cycling effects, the firm claims. They have been tested in a variety of process applications where temperatures routinely rise to above 300°C. Suggested applications include quartz tube seals, plenum seals, chamber seals and center ring seals.

Kalrez 8900 parts for aggressive thermal environments complement DPE's dry-to-wet range of perfluorelastomer parts (Kalrez 9100, Kalrez Sahara 8085, Kalrez 8002, and Kalrez 6375UP).

At both SEMICON Europa and the Solar Power International event in San Diego, CA, DPE also introduced Kalrez perfluoroelastomer parts designed specifically for the photovoltaic (PV) market.

DPE claims that, for both wafer-based and thin-film PV processes, Kalrez parts demonstrate broad chemical compatibility and good thermal stability, and can be used to help improve sealing reliability in critical PV wafer processing equipment that use plasma, high heat, and aggressive chemicals.

Kalrez 8900 and PV 'O'-rings.

DPE says that, as PV manufacturers use more aggressive and efficient chemicals and higher temperatures to boost uptime and improve output, more strain is being placed on the manufacturing process. Unplanned maintenance due to incompatible sealing materials can interfere with production schedules. Kalrez parts can cut downtime dramatically due to less preventative maintenance (PM), increasing productivity and reducing cost of ownership in the production environment, claims DPE.

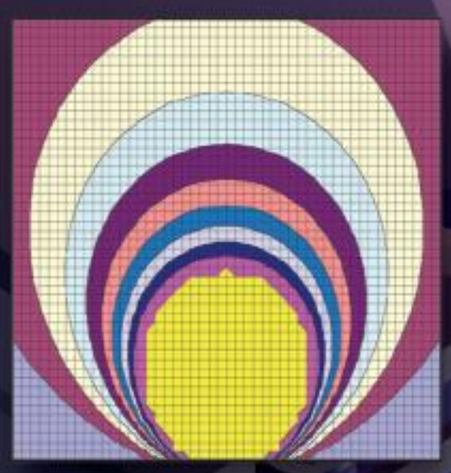
Four Kalrez product groups have been launched for PV manufacturing as well as for polysilicon feedstock production and abatement systems:

- PV8030 for surface texturing, polysilicate removal and 'wet' scrubber/abatement applications;
- PV8050 for edge isolation, anti-reflective coating (ARC), copper indium selenide (CIS), copper indium gallium diselenide (CIGS) and cadmium telluride (CdTe) cell layer and transparent conductive oxide (TCO) deposition;
- PV8070 for doping, metallization, and CIS/CIGS cell layer deposition;
- 9100 for amorphous/microcrystalline silicon cell layer deposition.

"We have recently sampled the new products to select PV customers and the initial results have been outstanding," says global business manager Rudy van Engen. "We expect that the PV market will experience similar reduced maintenance costs and greater equipment uptime as our more established markets have seen."

www.dupontelastomers.com

No Guesswork...



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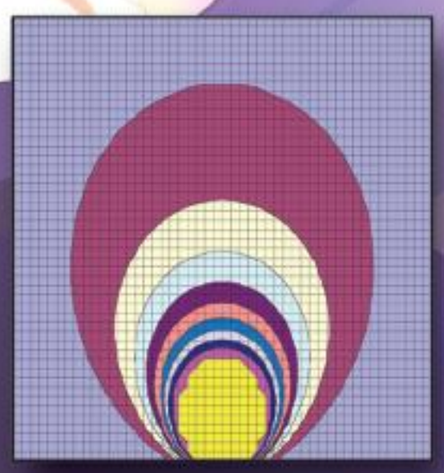

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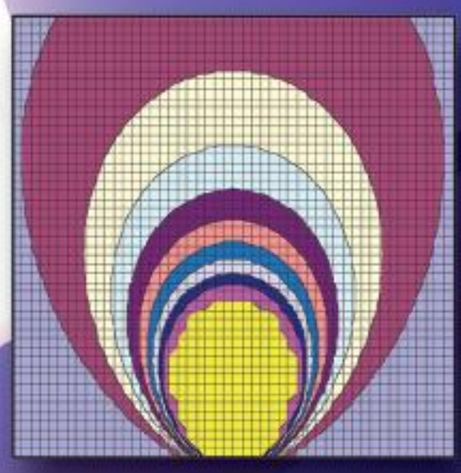

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www.temescal.net

IN BRIEF

EVG appoints general manager of Korean subsidiary

Wafer bonding and lithography equipment maker EV Group (EVG) of St Florian, Austria has appointed Dr Weonsik Yang as general manager of subsidiary EV Group Korea Ltd in Seoul (opened in June). He succeeds Bioh Kim, acting general manager, who will refocus his role as business development manager at EVG North America.

Leading EVG's strategic efforts in the Korean region, Yang will focus on strengthening regional customer sales, service and support efforts, as well as expanding on existing R&D partnerships.

"Our aim is to provide our customers with the best support possible, and we are taking deep strides to expand upon our commitment to the Korean market following the recent opening of our own subsidiary," says senior VP of sales Hermann Waltl. Yang will expand the subsidiary's reach and spearhead EVG's customer and R&D efforts in the Korean market. "His extensive capital equipment experience, both strategic and technical in nature, complements our needs."

Yang has over 15 years experience of the capital equipment sector including various roles during more than 10 years at Dongbu HiTek Co Ltd, including in its fab process engineering, technology planning, manufacturing technology, and production support teams. Yang started his career as a team lead at Iljin, where he managed its new business development team.

EV Group Korea Ltd serves as a direct-to-customer site for sales, service and support, supplanting EVG's sales and distribution partnership model to adapt to the growing customer demands for localized efforts.

www.EVGroup.com

KLA-Tencor to cut staffing by 15%

In response to current market conditions, process control and yield management solutions provider KLA-Tencor Corp of Milpitas, CA, USA plans to reduce its global workforce by about 15% by the end of June 2009. The staff cuts are part of several cost-reduction actions being taken to lower the quarterly operating expense run rate to $165–170m by the end of fiscal 2009 (the end of July 2009).

"Our employees are the heart of our organization, so it is with considerable reluctance that we are proceeding with this necessary reduction," says CEO Rick Wallace. "We will continue to monitor the demand environment and make the necessary adjustments to weather this downturn, help optimize our profitability, maintain our strategic focus and strengthen our competitive position."

In connection with the workforce reduction, KLA-Tencor expects to incur an initial charge of $15–20m (almost all of which is related to staff severance costs) as well as additional restructuring charges, severance costs and other related expenses at least through the remainder of fiscal 2009.

We will continue to monitor the demand environment and make the necessary adjustments to weather this downturn

www.kla-tencor.com

Goldeneye introduces flexible, freestanding GaN material

LED light source manufacturer and technology foundry Goldeneye Inc of Carlsbad, CA, USA has developed a freestanding gallium nitride film that, the firm claims, offers excellent crystal, optical, thermal, and electrical properties for commercial and research applications.

PlyGaN is a patent-pending, flexible, customizable all-nitride material that can be applied to a variety of substrates (either flat or non-flat surfaces), used freestanding, or laminated into multilayered structures.

Potential applications of PlyGaN include high-power electronics, solar cells, and three-dimensional micro-electro-mechanical system (MEMS) devices. "It has the potential to improve device performance in any application using nitrides," claims VP of technology Scott Zimmerman.

Goldeneye is offering PlyGaN in multiple configurations, starting with 1cm x 1cm squares in 30–100μm thicknesses. Larger custom configurations are also available upon request.

PlyGaN was developed initially for Goldeneye's patent-pending EpiChip LED (announced in December 2007). However, the firm says that it recognized the material's unique properties and is now making it available to companies interested in developing other applications for the material.

Goldeneye says that it is also prepared to work with companies in developing finished products, says Zimmerman. "Depending on the application, Goldeneye can integrate multiple device structures in the material as well as interconnects".

www.goldeneyeled.com

Replisaurus secures €7m to commercialize metallization technology for chip packaging

Replisaurus Technologies Inc of Kista, near Stockholm, Sweden says that Noble Venture Finance has committed venture financing of €7m that puts it in a strong position to start commercializing its new, clean metallization technology for high-volume chip packaging.

The financing is one of the largest commitments that Noble has made to a technology company.

"Given the difficult economic climate, it shows that companies with strong, forward-looking technology can still attract investments," says CEO James Quinn. Last month Replisaurus won a EuroAsia IC Industry Cleantech award for its ElectroChemical Pattern Replication (ECPR) technology. The firm says that its electrochemical replication principle combines the precision and resolution of advanced lithography with the ease and efficiency of electrochemical deposition into a single integrated process, eliminating many steps from the traditional packaging process, as well as solvents, developers and strippers.

"Our economical, fab-friendly, environmentally clean technology will help other companies reduce their carbon footprint," Quinn adds.

Along with its environmental benefits, Replisaurus claims that ECPR reduces metallization complexity, and boosts production speed, addressing both technical and economic issues. Initial target markets include key growth sectors such as integrated passives, copper pillars and 3D integration.

Companies with strong, forward-looking technology can still attract investments

"Replisaurus has a strong enabling technology focused on a large and growing market and it has impeccable cleantech credentials," says Noble Venture Finance director Andrew Webster. "It has attracted investment from the top tier of Europe's venture capital community, and the first-class management team has real passion that has attracted key industry specialists to join the company."

Early in October, Replisaurus announced that Mike Thompson, former deputy CTO of STMicroelectronics, had joined the firm as its chief operating officer.

Thompson is in charge of the integration of ECPR technology into a high-volume manufacturing solution, in preparation for commercial sales.

www.replisaurus.com
www.nobleventurefinance.com

Rubicon slashes Q4 revenue guidance; expects loss

For third-quarter 2008, Rubicon Technology Inc of Franklin Park, IL, USA, which makes sapphire substrates and products for the LED, RFIC, semiconductor and optical industries, has reported revenue of $11.8m, up just 2% on last quarter (though up 29% on a year ago). Previously, in mid-September, Rubicon lowered its revenue guidance for Q3/2008 from $12.5m to $11.5–12m.

Non-recurring items included $1.3m of contracted research revenue based on milestones met in the development of 8-inch substrates for the silicon-on-sapphire (SoS) market, and a loss on disposal of assets of $1.2m.

Rubicon was impacted by the significant short-term challenges that many of its customers are facing as a result of the global economic downturn, says CEO Raja Parvez. "The weakness in consumer spending associated with the global economic downturn has significantly impacted our LED and SoS customers," he adds.

In mid-September, Rubicon announced that, due to the slowdown in handheld device and small-display markets affecting both LED-making customers of its small-diameter (2-inch) LED wafers as well as its main SoS customer (RF communications IC maker Peregrine Semiconductor Corp of San Diego, CA, USA), it had executed contract modifications that shifted delivery of nearly $7m of product scheduled for 2008 into first-half 2009 (when customers believe the market will begin to strengthen). Subsequently, in early October, Peregrine told Rubicon that it would not take any further sapphire shipments until further notice due to declining demand for its products.

"Our customers have very little demand visibility at the moment, which makes it difficult to project our future revenues," Parvez says. Fourth-quarter 2008 is expected to be particularly challenging as customers continue to work through their inventory, he adds. September's Q4/2008 revenue guidance of $8–8.5m has now been lowered to just $4–6m, resulting in a $1–2m net loss.

The weakness in consumer spending associated with the global economic downturn has significantly impacted our LED and SoS customers

"We are retiring some of our older equipment, which will be replaced by newer, more efficient equipment this year and early next year," says chief financial officer Bill Weissman. "This initiative will improve our margins by reducing operating costs and increasing throughput."

In addition, in third-quarter 2008 Rubicon saw very positive signs of the LED industry moving to larger-diameter substrates, which is the firm's greatest strength, according to Parvez. "We are excited by the advancements in the LED industry and about our positioning to address this evolving market," he adds. "While these are challenging times, we have a strong balance sheet and great relationships in the market, which will enable us to manage through these short-term challenges."

Our customers have very little demand visibility at the moment... Fourth-quarter 2008 is expected to be particularly challenging as customers continue to work through their inventory

www.rubicon-es2.com

Rubicon announces stock repurchase program

Rubicon Technology says that its board of directors has authorized a stock repurchase program to purchase up to $15m of common stock over a period of two years.

The program authorizes the firm to repurchase shares of its common stock in the open market at times and prices considered appropriate by the company, depending on prevailing market conditions and other corporate considerations. Rubicon currently has 21,279,692 common shares outstanding.

"The stock repurchase program is a reflection of the company's strong financial position and ongoing commitment to increasing shareholder value," says CEO Raja Parvez. "We believe that, at current price levels, Rubicon's shares are an attractive investment, and our repurchase program reflects our continuing confidence in our market position and prospects for the future," he adds.

Our repurchase program reflects our continuing confidence in our market position and

Emerging Standardization for Sapphire Substrate Inspection

By Frank Burkeen

Senior Product Marketing Director at KLA-Tencor
Frank.Burkeen@kla-tencor.com

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The HBLED industry continues to thrive driven by market demand from mobile devices, automobiles, computer screens, and niche exterior and interior lighting applications. As HBLED device technology evolves and fabrication techniques become more advanced, defect detection and process control are critical to improving device yields. Sapphire substrate contaminants such as particles, scratches, pits, bumps, stains and residues from CMP processing are known to impact subsequent epi deposition processes and substantially degrade device performance and yield. As such, the need for higher quality sapphire substrates is of critical concern for HBLED device manufacturers.

The adoption of optical surface analyzer (OSA) technology is gaining momentum for use in HBLED manufacturing, specifically sapphire substrate inspection.

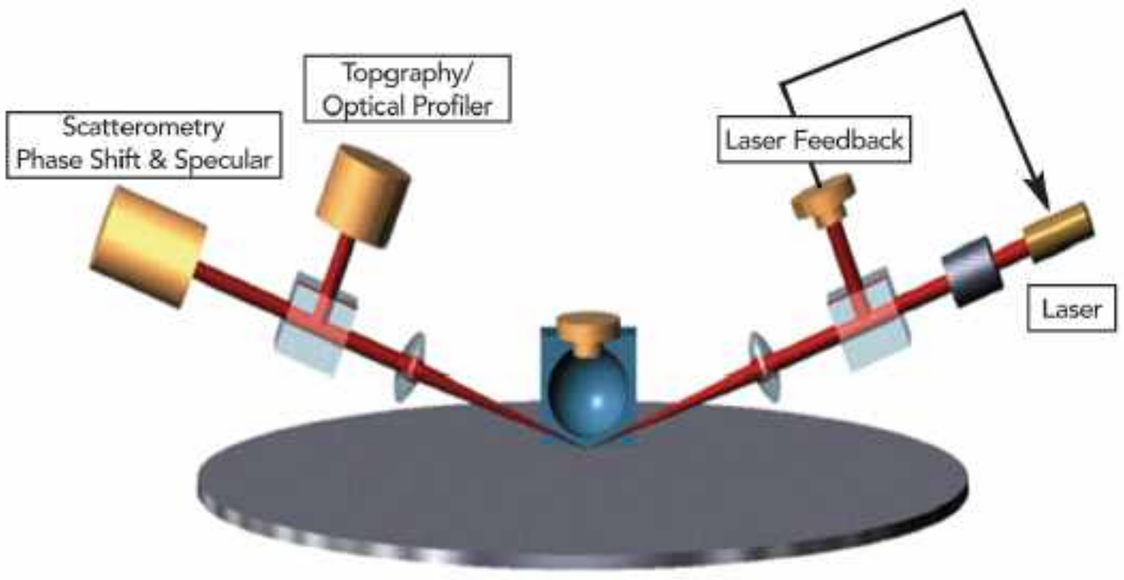


Figure 1: OSA technology combines four signal detection channels, enabling a wide range of inspection applications.

The design of OSA technology combines reflectometry, optical profilometry, scatterometry, and phase shift to measure topographic variations and detect a wide variety of surface defects. The inspection method achieves full surface coverage in minutes to produce high-resolution imaging, wafers maps, and automated defect classification.

At a throughput exceeding 40wph, an OSA system is the only wafer inspection method amenable to volume production and capable of advanced inspection of transparent sapphire substrates. Other inspection tools based solely on scatterometry cannot effectively measure transparent materials due to scattered light interference from the backside of the substrate. An OSA system is designed specifically for defect detection and classification of transparent materials including sapphire, GaN, SiC, and glass.

Figure 2 illustrates a sapphire substrate defect map after OSA inspection. Particles, scratches, pits, and stains are detected and classified in user-defined bins. The defect traceback images show a scratch as detected in the topography channel and two different types of stains as detected in the phase channel.

Scratches are known to transfer to the subsequent epi layer thereby degrading or killing device performance. Substrate stains have been reported to cause poor epi layer adhesion or result in rough epi morphology.

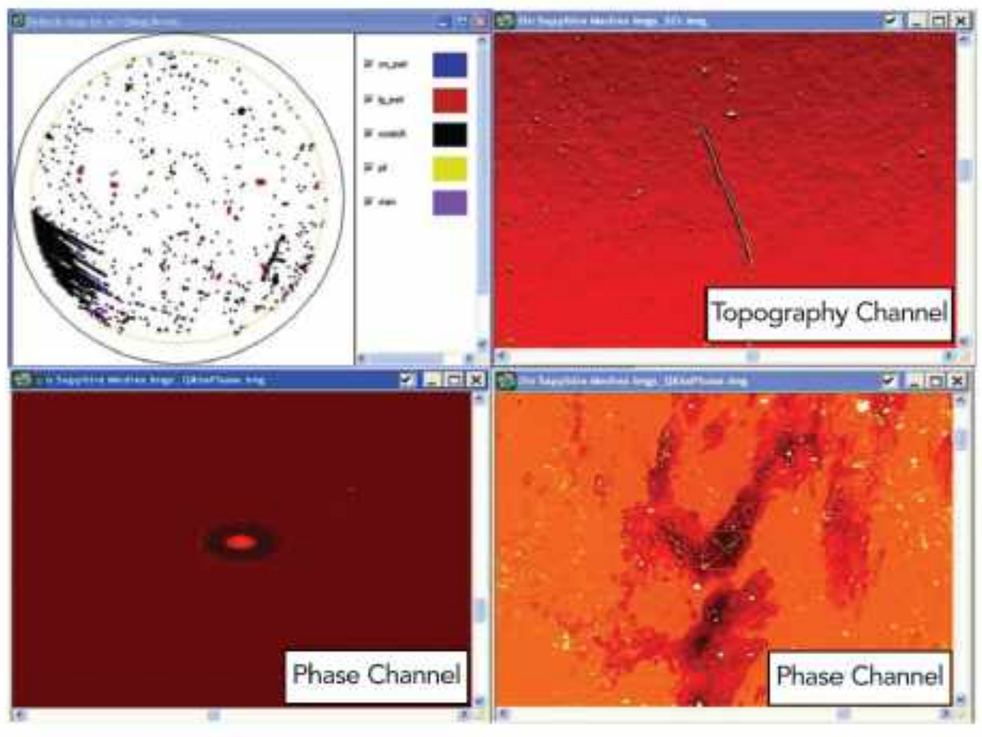


Figure 2: KLA-Tencor's Candela™ OSA defect map and traceback images of scratches and stains as detected in topography and phase channels, respectively.

As HBLED competition tightens and margins are squeezed, manufacturers are relying more on automated OSA inspection technology for process control and yield improvement. The emergence of sapphire substrate reclaim is also driving the need for advanced automated inspection. As supply is strained and material costs rise, the sapphire reclaim business is becoming more prevalent — whether for captive consumption or merchant supply. The reclaim business is even more dependant on OSA inspection as reworked material is highly susceptible to yield impacting defects.

Optical surface analyzer technology is setting the benchmark for automated inspection of sapphire substrates, and is emerging as the industry standard for overall sapphire quality control. HBLED device manufacturers and sapphire substrate suppliers are together converging on OSA inspection specs for quality assurance. Moreover, manufacturer's utilizing OSA technology are the beneficiaries of higher quality sapphire substrates passing distinct inspection specs.

Optical surface analysis technology enables manufacturers and suppliers to automate defect inspection and define objective-controlled process control limits. OSA technology can be employed at incoming substrate inspection, post-clean inspection, and after epi and film deposition processes.

To learn more, go to:
www.kla-tencor.com/candela

Cree grows 24% year-on-year to record $140m revenue

For fiscal Q1/2009 (ended 28 September), Cree Inc of Durham, NC, USA has reported record revenue of $140.4m, up 3% on last quarter and 24% on $113.4m a year ago.

Growth is due to LED revenue of $123.3m, up 6% sequentially and 32% on $93m a year ago. This was led by double-digit growth in both XLamp sales (boosting LED components as a share of total revenue) and Cree LED Lighting Solutions (LLS) products (although the latter was at the lower end of the targeted range, constrained by delays in ramping up several new products).

This growth offset non-LED product and government contract revenues falling 12% sequentially to $17.1m. In particular, commercial power and RF product revenue fell 14% due to lower silicon carbide Schottky diode power device sales as two major power supply customers reduced orders in response to anticipated slower demand in the IT sector.

Due mainly to higher utilization in the LED chip plant and improved XLamp yields, gross margin has grown strongly from 30.6% a year ago and 33.7% last quarter to 35.2%.

Operating expenses were a higher-than-targeted $44.7m (up from $35.7m a year ago), due mainly to R&D spending growing from $12.8m to $17.3m (largely for LED chip development and LLS products).

Net income was $5.9m, down on $8.4m last quarter. Yet free cash flow (cash flow from operations of $42.1m minus capital expenditure of $11.9m) was $30.3m (up from $18.5m). Cash and investments are $339.1m. "We don't need to raise capital," says chairman & CEO Chuck Swoboda.

Earlier in October, Cree entered into a long-term strategic agreement for lighting fixture firm Zumtobel Group to supply Cree's LED downlights through its sales channels in Europe, with shipments starting this quarter (accelerating the firms' business relationship, which should expand to other high-volume lighting categories in 2009). "While the current economic uncertainty has made forecasting the business more challenging, we continue to target growth driven by increased demand for our XLamp LED and LED lighting solution products," says Swoboda.

During the quarter, Cree released the new XP and MC series of XLamp LEDs to initial production, bringing lighting-class performance to new package form factors (addressing a wider range of lighting applications). Initial production in Durham will transition to high-volume production at Cree's factory in Huizhou, China in fiscal second-half 2009.

For fiscal Q2 (ending 28 December), Cree expects further revenue growth to $142–146m, driven again by double-digit growth in XLamp LEDs and LLS products, offsetting slight drops in LED chip, materials and contract revenues. Gross margin should be 35–36%, with slight improvement from current products being offset by higher costs on the ramp-up of several new products. To improve margins over the next year, Cree remains focused on further yield improvements at the chip and package level, capacity additions in Asia, volume benefits due to increased factory loading, and the transition of LED chip production to 4" wafers, says Swoboda.

"We've seen some signs of lower demand for our power products and IT-related applications, but current customer forecasts for LED product remain pretty solid," says Swoboda. However, Cree is becoming more cautious about fiscal Q3 (historically a slower quarter). "The economic uncertainty and lack of consumer confidence will eventually have some impact on the markets we serve... As a result, we are taking a more conservative approach to operating expenses and capital spending in the near term," he adds.

For more than a quarter now there has been excess capacity and low utilization rates among LED chip makers in Taiwan, which already compete very aggressively on low-to-medium end consumer applications, says Swoboda. By comparison, Cree is impacted less by consumer issues, he reckons. Apart from the conversion of PC notebook backlighting to LEDs helping revenues, over the last couple of years Cree's strategy has been to focus its LED chip business more on higher-end lighting applications. So, Cree is well positioned to take advantage of the growing trend for energy-efficient lighting. Cree has seen continued growth in demand for its flagship LR-6 product as well as strong initial orders for the soon-to-be-released LR-24.

However, to better serve the growing LLS customer base, Cree recognizes it needs to boost finished goods inventory in North America. The firm is working to resolve the manufacturing bottlenecks, says Swoboda .

For more than a quarter now there has been excess capacity and low utilization rates among LED chip makers in Taiwan

"We still plan to make new investments to support the targeted growth in LED components and lighting product sales." Cree targets capital expenditure of $15–18m in fiscal Q2, mainly for extra capacity, new product launches and the continuing transition of LED chip production to 4" SiC wafers — Cree is on track to have all major product lines fully converted by the end of fiscal 2009 (the end of June).

Cree also aims to transition the commercial power and RF product line from its slight quarterly loss to profitability in fiscal 2010. It recently gained its largest order for commercial RF devices, which should give a solid base of RF business over the next year and help offset fluctuations in demand for power products. In the next year Cree aims to realize more potential from SiC Schottkys from a broader customer base, and is working to increase both direct and distribution sales coverage.

www.cree.com

Madison Area Technical College and University of Notre Dame join LED University Program

LED maker Cree Inc of Durham, NC, USA says that both Madison Area Technical College (MATC) in Wisconsin and the University of Notre Dame are joining the LED University program.

Launched in April, the LED University initiative is an international community of universities working to evaluate, deploy and promote the adoption of energy-efficient LEDs across their infrastructures (in areas such as offices, student housing, parking garages, walkways and streets). The aim is to save energy, protect the environment, reduce maintenance costs, and provide better light quality for improved visibility and safety. MATC and the University of Notre Dame join inaugural participant North Carolina State University as well as University of California at Santa Barbara, the University of Arkansas and Marquette University in the USA, and Tianjin Polytechnic University in China.

MATC is the technical and community college for the greater Madison, Wisconsin area, and is one of the largest of the Wisconsin Technical College System's 16 colleges (serving 44,000 individuals annually). It began installing LED lighting fixtures in mid-2007 with eight BetaLED bollard lights that illuminate student walkways on its downtown campus. Currently, about 400 LED fixtures illuminate a number of MATC campus venues, including outdoor walkways, the student center, administration offices, bus-stop shelters, and display cases.

"We estimate that MATC is achieving, on average, a 30% reduction in energy use for lighting across a variety of indoor and outdoor applications. That's pretty impressive, given that indoor LED lighting installations have replaced T8 fluorescent tubes, which had previously been considered the most energy-efficient option," says MATC's engineering services manager Wes Marquardt. "We are committed to energy conservation while at the same time providing good lighting levels for our staff and students. We are evaluating LED lighting across nearly every lighting application and deploying LED lights when they meet our requirements for energy savings and light quality," he adds.

Bollard lights illuminating student walkway at MATC.

"MATC is demonstrating the significant energy and overall cost savings of LED lighting for higher-education applications," says Deb Lovig, Cree's LED programs manager. "MATC is choosing to use LED lighting on campus wherever it provides significant return on investment." Current MATC campus LED lighting installations feature LED lighting fixtures from a number of vendors.

The University of Notre Dame is implementing four pilot installations to evaluate the feasibility of LED lighting across its campus. The pilots include LED step lighting from BEGA-USA on its new Irish Green, recessed LED lighting from Cree in the Facilities Building conference room and in the elevator lobby of Hesburgh Library, and outdoor decorative area lights from Sternberg Lighting on central campus.

Outdoor decorative area lights at Notre Dame.

Because it is illuminated 24 hours a day, energy savings in the library's elevator lobby are particularly high: 81% compared with the previous incandescent lighting and 50% for the outdoor lights compared with the previous metal halide lighting. Considering that the campus lies on 1250 acres and includes 137 buildings, potential savings from widespread use of LED lighting are tremendous.

The Facilities Building conference room was completely relit with LED lights, providing much improved light quality and energy savings of about 80% compared with the previous fluorescent troffers and recessed lights. The university installed a combination of energy-efficient Cree LR6 and LR4 recessed lights and the new LR24 two-foot by two-foot LED recessed light (which all provide dimming capabilities for optimizing lighting levels).

"Addressing energy and maintenance costs for campus lighting is one of the most effective ways we can reduce energy use, achieve our sustainability targets, and save money," says James Mazurek, Notre Dame's director of sustainability. "On average, Americans use 22% of energy for lighting [according to the US Department of Energy], so it makes sense to target lighting in our efforts to become a campus leader in sustainable business practices," Mazurek adds.

"We encourage universities to approach LED lighting implementation as Notre Dame has," says Lovig. "Pick three or four distinct applications to install various LED lights, and then measure the quality of light as well as energy and maintenance-cost savings. If the light is better, energy is saved and maintenance costs are significantly reduced, moving to LED lighting from older technologies is a no-brainer," she concludes.

www.leduniversity.org

New LEDs for headlamps, camera flashes & video displays

Osram Opto Semiconductors GmbH of Regensburg, Germany says that, with its integrated shutter, its new OSTAR Headlamp LED simplifies optical systems by efficiently emitting clearly defined light without the need for further external shutters. The LED is now equipped with one, two, three, four or five chips and can be used for any headlamp design, allowing the creation of different illumination patterns and lighting scenarios. Instead of the usual silicon encapsulation, a glass cover bonded to the frame protects the chips and prevents scatter losses.

The OSTAR Headlamp LED produces between 125lm at 700mA (one chip) and 1000lm at 1A (five chips). The brightness from an unchanged power rating of 12W results from improvements in the chips, the converter and the package.

The thermal resistance for the five-chip version is about 3K/W. "Development work is continuing," says Peter Knittl, head of Automotive Marketing LED. "We expect there to be a continual reduction in thermal resistance to a much lower level than at present."

Unlike mechanical shutters, a high-precision shutter integrated into the glass provides a clearly defined beam pattern without losing light. Compared with conventional solutions, the mounting depth is greatly reduced. The glass cover also makes the LED more robust.

With a color temperature of 6000K, the light is very close to that of natural daylight, so drivers do not get tired so quickly, says Osram Opto. Also, oncoming drivers are not dazzled, since headlight makers can design the bright/dark transition areas with great precision.

Different lighting scenarios can be created (e.g. high beam, low beam and cornering beam) by combining different chip configurations on which lenses can be mounted. Compared with classic HID projection systems, which emit 35–45% of the light produced, the LED solution emits 10% more, the firm reckons.

● Osram Opto is also launching two new MultiLEDs for different LED video displays, both based on high-power chips in Osram Opto's latest Thinfilm and ThinGaN technology.

The MultiLED in the black package has been developed for high-resolution displays, targeted at the professional entertainment industry (e.g. theater shows and trade fairs). Typical luminance is 2000cd/m^2 and pixel spacing is 5–7mm. As the blackest LED on the market, the firm claims, it provides excellent contrast and depth of color. The color appears on the display as a deep black, giving pictures great depth and creating 3D effects. "Achieving a consistent black level has been the greatest hurdle so far in presenting the color black properly," says Dr Volker Härle, senior director LED Marketing. "Pictures will now have much more intensive depth."

The MultiLED in the white package offers exceptional brightness and is suited to high-resolution perimeter advertising systems or displays with high brightness requirements. Both versions offer color fidelity across the entire viewing angle such that there are no discernible color differences even in the horizontal direction.

The white points are at 750mcd for the black package and at 2000mcd for the white package. They are supplied in very narrow tolerances in terms of brightness and color location to ensure homogeneous display results. Display colors remain constant from all viewing angles. Also, the multichip LEDs' 6-lead design ensures good heat removal and allows current of 15mA per color even at 85°C ambient temperature.

● Osram Opto Semiconductors says that its new-generation Ceramos and Oslux LED flash products are twice as bright as their predecessors, meeting requirements imposed by the higher resolutions achievable by modern digital cameras.

Ceramos is one of the brightest LED without a lens for flash photography, the firm claims, producing 90lm from an operating current of 500mA. Light is produced by ThinGaN chips measuring just 1mm^2.

Clear encapsulation produces very bright light, but it is also available with diffused encapsulation for a neutral-white appearance (appearing radiant white, even when not in use, and usable as a design element). The LED with transparent encapsulation appears slightly yellow.

The Oslux, with its special lens, suits use without external optics in cell phones or digital cameras. The new LED has an optimized chip and lens design that increases brightness: 100lx from an operating current of 500mA (higher brightness is achievable with higher operating currents).

New-generation products are twice as bright as their predecessors

"A sizeable proportion of modern cell phones equipped with LED flash units use our high-flux LEDs," says Dr Volker Härle, senior director LED Marketing. Uptake of the new LED flash products will be assisted by the new brighter products having the same connections, he reckons, so they can be used as direct replacements for the previous generation of LED flash units.

www.osram-os.com

Cree launches oval HB-LEDs for digital billboard and signage applications

LED maker Cree Inc of Durham, NC, USA has launched its new-generation Screen Master 4mm and 5mm oval high-brightness LEDs in blue, green and red colors.

The new oval LEDs feature optically matched radiation patterns in blue, green and red, resulting in what is claimed to be superior image quality for digital billboard and full-color sign applications.

In Cree's unique matched-radiation pattern, the red pattern is inside the blue and green, resulting in a blended cool-white light, compared to the pink that results when unmatched LEDs are used.

Available in a wide range of intensities and colors, the oval LEDs feature a wide viewing angle and enhanced contrast, suiting the signage market. The use of LEDs in signs and displays helps to lower the power requirements and maintenance expense compared to other technologies.

"Customers can now purchase the brightest blue, green and red ovals from a single supplier," says Norbert Hiller, Cree's VP & general manager of LED Components. "These products offer superior intensity for the rapidly growing video-board and signage markets," he claims. "This will give customers additional flexibility to design-in the precise part they need—spanning a range of sizes and brightness levels."

Cree's Screen Master red, green and blue oval high-brightness LEDs.

The Screen Master 4mm and 5mm oval LEDs, C4SMF-RGS/GJS/BJS and C5SMF-RGS/GJS/BJS, are available through Cree's global distribution network.

www.cree.com/hbdistributors

US court rules in favor of Seoul Semiconductor against Nichia

Korean LED maker Seoul Semiconductor Co Ltd says that the US Court for the Central District of California has rendered a judgment denying all the claims of Japanese LED maker Nichia Corp and Nichia America Corp in a lawsuit that Nichia filed against Seoul Semiconductor in December 2007 under the Lanham Act and California state law.

The lawsuit started over statements to the media by Seoul Semiconductor regarding earlier design patent litigation between Seoul Semiconductor and Nichia. Seoul Semiconductor filed a motion for a summary judgment (a legal determination of the case without a full trial) against Nichia's claims.

After considering both parties' arguments and evidence, the US court has now found there was no evidence that Seoul Semiconductor's actions caused any injuries to Nichia. The court has therefore entered final judgment in favor of Seoul Semiconductor.

The content of the judgment is as follows:

- Nichia shall recover nothing from Seoul Semiconductor;
- Seoul Semiconductor shall have judgment in their favor on all of Nichia's claims; and
- Seoul Semiconductor shall recover from Nichia their costs for the lawsuit.

www.seoulsemicon.com/en

IN BRIEF

QPC fights off bankruptcy

In mid-October, QPC Lasers of Sylmar, CA, USA, which makes high-power lasers for the consumer electronics, industrial, defense and medical markets, laid off about two-thirds of its 60 or so staff, before resuming manufacturing, engineering and sales operations on a limited basis about a week later.

Founded in 2000, revenue grew from $1m in 2005 to $3m in 2006 then nearly $8m in 2007, but has fallen from $2.8m in Q4/2007 to just $1.3m in Q2/2008. Meanwhile R&D costs have driven net loss from $1m to $4.7m, while cash reserves have shrunk from $6.4m to just $463,000.

Despite having more than $14m of orders (including from rear-projection TV maker Asia Optical), in early September, QPC failed to raise extra capital and restructure its debt ($25.3m, involving interest payments of $6m in 2009).

Consequent resignations included Paul Rudy as VP of sales & marketing, and Blima Tuller as VP of finance & chief accounting officer.

Subsequently, in October, QPC defaulted on interest payments of over $65,000. This included:

- $22,000 due on the remaining $263,880 of a $0.5m February 2007 equipment sale-and-lease-back agreement, payable at an interest rate of 33.65% per annum to Boston Financial & Equity Corp (which sought to repossess the equipment);
- $44,000 due on $5.4m still owed under a $6m loan agreed in September 2006 with fiber-optic component maker Finisar Corp, which threatened to seize collateral (most of QPC's assets, including intellectual property).

QPC has hence said that it may file for Chapter 7 bankruptcy protection.

www.qpclasers.com

Alfalight wins $1.36m Army contract to develop 1kW laser pump source

Alfalight Inc of Madison, WI, USA, which manufactures high-power diode lasers for industrial, defense and telecoms markets, has received a $1.36m contract from the US Army Research Laboratory (ARL) in Adelphi, MD.

The firm says that the 12-month program High Brightness Diode Sources II (HiBriDS II) will enable it to extend the success of previous programs to create solid-state laser diode pump sources with higher brightness and reliability than current technology can provide. The objective is to demonstrate 1kW of 975nm narrowband, wavelength-locked diode laser light coupled into a 600μm diameter fiber with a numerical aperture (NA) of 0.22.

Alfalight's past performance in DARPA's ADHELS (Architecture for Diode High Energy Laser Systems) and ARL's HiBriDS programs has allowed it to push both the spatial and spectral brightness of pump diodes by implementing brightness-enhancement and wavelength-stabilization technologies, says the firm's VP of research and development Manoj Kanskar. "The extended scope of HiBriDS II will allow us to make a significant improvement to the brightness and power of cost- effective kilowatt-class pump modules," he adds.

The new design will require less demanding manufacturing tolerances and fewer optical components to scale power, allowing resultant products to be more cost-effective and robust compared to fiber-coupled bars.

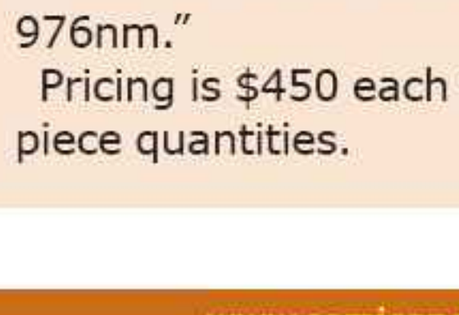
Products from the HiBriDS II program will also combine Alfalight's integrated wavelength-stabilization technology, high power-conversion efficiency, and proven packaging expertise to enable products requiring only industrial water cooling, rather than micro-channel cooling.

Applications will include defense systems, commercial fiber-laser pumping, and solid-state laser pumping as well as direct-diode materials processing.

www.alfalight.com

Alfalight launches 976nm, 10W uncooled pump laser to 915nm and 940nm series

Alfalight has launched the AM6-976E series of 976nm, 10W uncooled pump laser diodes for industrial fiber-laser applications (pulsed fiber lasers and fiber amplifier systems). The new devices complete a series of 10W products emitting at 915nm and 940nm launched earlier this year.



Offered in a compact, Telcordia-qualified, fully hermetic 6-pin package, the new higher-output 976nm diodes include a thermistor for temperature monitoring, supporting precision wavelength control (±4nm) at 976nm, and are available with high-brightness 105μm, 0.15 NA fiber (AM6-976E-10-104) or 105μm, 0.22 NA fiber (AM6-976E-20-104). The expected mean time to failure exceeds 100,000 hours.

"This device delivers an important step forward in pump brightness and cost-effectiveness," claims Ron Bechtold, VP of sales & marketing. "The pulsed fiber laser market will grow dramatically in the coming years, and Alfalight intends to continue to offer a stream of solutions centered at 976nm."

Pricing is $450 each for 10,000-piece quantities.

Advanced Photonix's revenue hits a record $8.2m as firm maintains 30% full-year growth forecast

For its fiscal second-quarter 2009 (ended 26 September), vertically integrated optoelectronics manufacturer Advanced Photonix Inc of Ann Arbor, MI, USA has reported net sales of $8.2m, up 5% on $7.8m last quarter and 25% on $6.5m a year ago, driven by military and industrial/NDT (non-destructive testing) markets.

On a non-GAAP basis, net income was $307,000, down from $869,000 last quarter but still an improvement on a net loss of $86,000 a year ago.

"The balance and strength of our three product platforms continues to give us the ability to meet our growth targets in this challenging economic environment," says chairman & CEO Richard Kurtz. Products include patented silicon, InP- and GaAs-based APD, PIN, and FILTRODE photodetectors; high-speed optical receivers (HSOR); and the T-Ray 2000 and QA1000 THz (terahertz) instrumentation platforms. "Our market opportunities and product platforms complement each another, and each product platform gives us a solid foundation to grow," he believes. The strongest growth came from military, industrial and homeland security markets.

"We continue to believe we are in a strong multi-year growth period, but can still experience uneven quarterly revenue growth in our product platforms as our customers continue to test, qualify and deploy next-generation 40G HSOR and terahertz systems," Kurtz continues. "We expect to continue to see fluctuations in our customers' spending in any given quarter due primarily to slower new product introductions and reduced capital expenditures due to current macro-economic conditions."

Each product platform gives us a solid foundation to grow

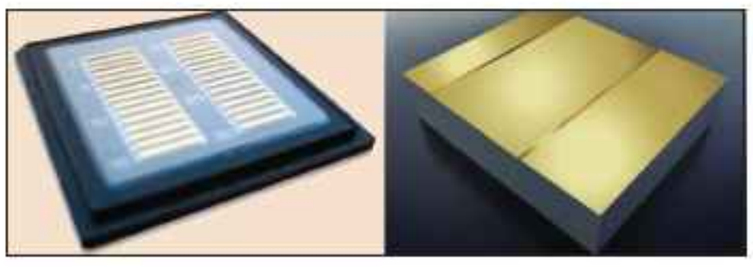
Kurtz says that, looking ahead, Advanced Photonix is taking a prudently cautious view of guidance for the balance of the year, and is maintaining its revenue growth target of 30% year-on-year.

www.advancedphotonix.com

Modulight's 20W 1470nm laser bar

Optoelectronic component maker Modulight Inc of Tampere, Finland has added a new member to its RangerLase family of products: the ML1818 high-power 1470nm laser bar, which produces up to 20W of continuous-wave output power. The product is also available as bare die, with an output power of 800mW (ML1817). The 1470nm lasers are targeted mainly at industrial and medical applications, such as soft-materials processing, plastic welding, and fiber amplifier pumping.

"We are seeing a nice surge in the demand for our eye-safe high-power lasers at 1470nm and 1550nm since the RangerLase product releases earlier this year," says product manager Ulla Haapanen. "The sales of this type of products have been boosted also by the recent supply issues faced by QPC Lasers, which eventually seems to even increase our market share for eye-safe high-power lasers."



Modulight's ML1818 high-power 1470nm laser bar (left) and the ML1817 in bare die form.

www.modulight.com

IN BRIEF

JDSU gains senior VP of corporate development & marketing

Optoelectronic chip and module maker JDSU Corp of Milpitas, CA, USA has appointed Sharad Rastogi as senior VP of corporate development & marketing, responsible for strategic planning, mergers and acquisitions and overall corporate marketing functions. He reports directly to president & CEO Kevin Kennedy.

"His track record of successful execution on strategic growth opportunities, specifically operational management and merger & acquisitions experience, support our priority of transformative M&A that will continue to shape and guide JDSU to a strong future," says Kennedy.

Rastogi was most recently VP of corporate development at Avid Technology Inc and general manager of its consumer business unit Pinnacle Systems, responsible for strategy, acquisitions, alliances and new business opportunities. Prior to Avid, Rastogi was a partner in management consultancy Bain & Company Inc, advising on corporate strategy, operational improvement, mergers and acquisitions, and post-merger integration.

Rastogi holds a master of business administration from the Wharton School at the University of Pennsylvania and a master of science in manufacturing engineering from Boston University.

"My areas of immediate focus will be pursuing strategic development that will fortify or augment JDSU's existing diversified technology portfolio and to uphold the commitment already established by this leadership team to advance the company's long-term business model," says Rastogi.

www.jdsu.com

CEO and 400 jobs go as JDSU closes seven CommTest R&D centers & three plants as Optical Comms and Lasers merge

For its fiscal Q1/2009 (to 27 September), JDSU of Milpitas, CA, USA has reported revenue of $380.7m, at the low end of its guidance range and down 2.5% on $390.3m last quarter.

Of total revenue, Americas' customers represented less than 45% (down from 50–54% the previous four quarters: despite strong growth in Latin America where greenfield build-outs are increasing, JDSU's top five North American customers are down 12% on last quarter due to spending push-outs and longer approval cycles in telecom and cable). Europe was level at 31% of revenue, while Asia-Pacific revenue grew 38% quarter-over-quarter to 24% of total revenue due to strength in emerging markets such as China and India, as well as new broadband deployments in Korea.

Advanced Optical Technologies (AOT) revenue was $53.5m (14% of total revenue), up 1.1% on last quarter. However, Communications Test & Measurement was $165.3m (43% of total revenue), down 3% due to a slowdown in North America. Commercial Lasers was $21.4m (6% of revenue), down 3.2% due to continuing lower demand from semiconductor equipment makers.

Optical Communications was $140.6m (37% of total revenue), up 21.2% on $116m a year ago but down 3.1% on last quarter. Double-digit growth in tunables (to record revenues) plus growth in reconfigurable optical add-drop multiplexers (ROADMs) was counteracted by JDSU pruning its portfolio of less profitable legacy products, e.g. low-speed (2–4Gb/s) datacom pluggables.

Overall non-GAAP gross margin has risen from 40.9% last quarter to 43.3%. Net loss has been cut from $29.8m to $16.4m, although this was still the firm's third consecutive quarterly loss. "JDSU achieved growth in non-GAAP operating income and free cash flow during a period of economic uncertainty," says president & CEO Kevin Kennedy.

Kennedy adds that fiscal Q1 shows the impact of lean and change management initiatives that began in part in fiscal Q4/2008 and should increasingly provide operating benefits throughout calendar 2009. "The recent upgrade in our systems infrastructure was a critical factor enabling this expanded activity."

JDSU's financial model aims to achieve quarterly revenue of $400m with sustainable operating margin of 10% and gross margin of 46%. For fiscal Q2/2009 (to 27 December), the firm expects revenue to be flat at $360–390m and operating margin of 4–8.5%. "We are experiencing cautious spending from our customers, given the current economic conditions," says Kennedy.

To expedite its lean and change management initiatives, JDSU is therefore making further organizational changes designed to simplify its structure and reduce costs.

The Optical Communications and Commercial Laser segments are being combined into a single Communications and Commercial Optical Product segment, with Alan Lowe as president and David Gudmundson (who drove Optical Communications strategy) in an advisory role. "This combination will enable us to leverage technology, our manufacturing model, and people as we continue to improve profitability," says Kennedy.

Staffing will be cut by about 400 (out of a total 6664)

JDSU thinks that, in Optical Communication, it can improve gross margin and increase operating margin by 3–5 percentage points over the next year through execution of its lean manufacturing initiatives, including pruning further products from the portfolio, transitioning products to contract manufacturers, increasing factory utilization, and improving the flow of materials from suppliers.

In particular, the Optical Communication segment's photonics unit continues to focus on high-value components such as VCSELs, modulators, pump lasers, passives and highly integrated components such as the first photonic integrated amplifier (PIA) platform (launched at September's ECOC 2008 event, replacing up to 50 discrete components with a single chip and up to 50% smaller than current solutions).

Regarding Commercial Lasers, JDSU is increasing its solid-state laser production volumes in concert with transitioning manufacturing to Asia (both to its plant in Shenzhen, China and to contract manufacturers) over the next 3–4 quarters. With sales to semiconductor manufacturers not expected to recover for several quarters, customers continue to transition from gas to solid-state lasers (now over 50% of laser revenue, and expected to grow to over two thirds during fiscal 2009). So, product development will continue to focus on advanced solid-state and fiber-laser platforms. In particular, introducing laser diode technology developed in the Optical Communications segment should boost the served market for Commercial Lasers more than threefold. JDSU believes it can improve Commercial Lasers gross margin and increase its operating profit by 4–6 percentage points over the next year.

Also, due to three consecutive quarters of falling sales from the CommTest division in North America, productivity improvements will include: eliminating seven R&D sites (consolidated from 19 to 12) and at least three plants in North America; outsourcing more to contract manufacturers; and product portfolio improvement, says Kennedy. Altogether, staffing will be cut by about 400 (out of a total of 6664).

Kennedy adds that he has resigned from JDSU and will leave at the end of December. However, he will remain on the board of directors in an active capacity as vice chairman.

www.jdsu.com

Infinera's revenues fall 11%

For third-quarter 2008, Infinera Corp of Sunnyvale, CA, USA, a vertically integrated manufacturer of digital optical network systems incorporating its own InP-based photonic integrated circuits (PICs), has reported revenues of $120.5m, almost double $62.2m a year ago and up from $161m last quarter. However, on an adjusted GAAP basis, revenue for invoiced shipments (excluding deferred ratable product revenue and related support and services) was $80.9m, up slightly from $80.4m a year ago but down 11% on $90.8m last quarter.

Excluding non-cash stock-based compensation and on an invoiced shipment basis, gross margin was 42%. This is down from 43% a year ago and 47% last quarter after being negatively impacted by about 4 percentage points due to initial shipments to Deutsche Telekom.

Operating expenses rose from $32.3m in Q2 to $35.9m due to R&D headcount increases as well as additional project and prototype expenses as Infinera continues to fund next-generation programs.

After net income of $10.9m a year ago and $10.7m last quarter, Infinera just broke even in Q3.

Nevertheless, revenue was ahead of the $75–80m guidance provided in July, points out president & CEO Jagdeep Singh, while cash generated from operations amounted to $9.9m (boosting cash, cash equivalent, restricted cash and investments to $324.6m).

"Both existing and new customers continue to turn to Infinera's PIC-based solution to build out their networks as they address their bandwidth growth needs," he adds. "We added five new customers in the quarter [bringing the total to 49] — including our fifth of the top five major cable MSOs [multi-system operators] in North America and two additional European customers."

Singh says the firm saw a strong reception from both the installed base and new customers to the new Infinera Line System 2 (ILS2), which began shipping in August. ILS2 provides extended reach and increased capacity for the existing DTN system and is designed to allow it to scale to 8Tb/s in the future. "We are pleased with the resumption in new customer-win momentum, and we believe that this will continue into Q4 with the addition of at least another four new customers," says Singh.

During Q3, Infinera also completed migration of the Deutsche Telekom (DT) Western European network to its equipment in just five weeks, highlighting the speed of service advantage that Infinera's architecture provides, claims Singh. Traffic was migrated from the previous incumbent DWDM platform on to Infinera's equipment using only the existing single pair of fibers without requiring additional fiber, as would have been the case with the conventional WDM solution. DT is now running live traffic on the new network. "This represents a significant achievement for the Infinera and DT teams, and it is serving as a strong reference account for our new business efforts," says Singh.

Also in Q3, Infinera achieved two key milestones. Its PICs surpassed a cumulative total of 100 million hours of operation in live networks worldwide without any PIC failures, evidence of the high reliability of the firm's photonic integration technology. Also, more than 10,000 Infinera DLM line cards shipped since the firm began commercial shipments in late 2004 (accounting for about 40% of all of the 10Gb/s long-haul ports shipped by the industry in this timeframe and equating to a total DWDM network capacity of 1Petabit per second).

Singh says that so far Infinera has not seen any significant changes in spending plans by customers that it can attribute directly to the current uncertain macro-economic conditions, but Singh expects this to change. Nevertheless, Infinera is maintaining June's guidance for full-year 2008 revenue growth of 10%, based on its Q4 revenue forecast of $75m.

Infinera has not seen any significant changes in spending plans by customers that it can attribute directly to the current uncertain macro-economic conditions

www.infinera.com

NTNC selects Infinera for multi-state research network

The Northern Tier Network Consortium (NTNC) has selected Infinera to provide a Digital Optical Network for a regional optical link connecting nine states from Seattle through Idaho, Montana, North Dakota, South Dakota, Minnesota, Wisconsin and Iowa to Chicago.

The new network will provide multi-wavelength networking resources to researchers at 27 member universities as well as connectivity to the nationwide Internet2 network.

The NTNC includes Pacific Northwest Gigapop, which supports the network in Washington; the University of Montana and Montana State University, which support the Idaho and Montana portions; and the University of North Dakota, North Dakota State University, and North Dakota state government, which support the North Dakota portion. The NTNC network also includes capacity provided by Infinera customers SDN Networks (in South Dakota) and BOREAS-Net (which spans Illinois, Wisconsin, Minnesota and Iowa).

Bookham reports its first profit following record revenue

For its fiscal first-quarter 2009 (ended 27 September), optical component, module and subsystem maker Bookham Inc of San Jose, CA, USA has reported record revenue of $66.5m, up 6% on $62.6m last quarter and 23% on $54.3m a year ago. Growth was driven by tunable products, amplifiers, and 980nm pump lasers.

Excluding stock compensation expense of $0.4m and $0.4m of one-time costs related to the transfer of San Jose photonics operations to Shenzhen, China, non-GAAP gross margin was 26%, up from 23% last quarter and 24% a year ago, boosted by the higher-volume low-cost Shenzhen plant. In particular, margins on Bookham's tunable lasers have risen to the industry average, and are no longer a drag on the profitability of the telecom business (for which margin now exceeds the overall gross margin of 26%), says president & CEO Alain Couder.

Even excluding a non-cash gain of $6.5m (from the foreign currency translation of intercompany balances between subsidiaries), non-GAAP net income was $4.7m, compared with net losses of $1.5m last quarter and $8m a year ago. This is Bookham's first profit since the firm went public in 2000.

Tunable lasers have risen to the industry average, and are no longer a drag on profitability

On a non-GAAP basis, adjusted earnings before interest, taxes, depreciation and amortization (EBITDA) were a record +$2.2m, an improvement from –$0.7m last quarter and –$2.5m a year ago.

The further quarter of financial improvement (including record revenue and adjusted EBITDA) was driven by progress with product innovation and operational execution, says Couder.

However, during the quarter, cash, cash equivalents, short-term investments and restricted cash fell from $51.9m to $43.2m. About $6m of this drop was due to receivables scheduled for collection in the last week of the quarter for which certain customers shifted payments into the first week of October.

In particular, three large North American customers (probably including 18%-customer Nortel Networks) have excess inventory. "The economic environment is reducing demand from some of our customers," warns Couder.

For its fiscal second-quarter 2009 (ending 27 December), Bookham expects revenue down at $57–62m, non-GAAP gross margin down to 21–26%, and adjusted EBITDA of negative $2m to positive $2m (break-even). "Our priority remains unchanged: to achieve sustained operating profitability," emphasizes Couder.

www.bookham.com

Bookham amplifier hits 10,000 hour life-test landmark

Bookham has demonstrated the reliability and stability of its telecom amplifier design and the Mini-DIL uncooled 980nm pump laser modules within it with results from 10,000 hour amplifier and 38,000 hour discrete-pump-level life-tests.

The three customized, compact, high-power amplifier gain blocks that underwent testing have a small form-factor design, taking advantage of the compact package size and low power consumption of the Mini-DIL uncooled pumps. The amplifiers operate at +19dBm output power and are typically deployed in single-channel applications within metro networks.

"The industry norm for life-testing amplifiers and other high-value modules and subsystems is just 2000 hours — we've carried out these life-tests to conclusively show that our amplifiers and pumps have industry-leading quality and reliability," says director of product management Mark Ives. "The market for line-side amplifier solutions is extremely competitive and is played out between just three dominant companies, so the systems houses look at product reliability as a key differentiator," he adds. "We are now at 10,000 hours for the amplifiers, but this testing will continue to build up valuable reliability information."

The parameters measured, in-situ every 6 minutes, included output power, noise-figure, and input and output monitor responses. The measurements read the health of the entire amplifier assembly, including all active and passive subcomponents within. The results demonstrate the high reliability of the design itself, the components, and the manufacturing process, says Bookham.

In a separate, discrete-pump-level extended life-test, a sample of the Mini-DIL uncooled pumps have been running at 200mW and 70°C (the product's uppermost operating conditions) for in excess of 38,000 hours (equivalent to about 20 years of operation under 'use' conditions. The pump life-test has revealed zero failures and shows no indication of onset of wearout.

Oplink controlling costs during near-term economic concerns

For its fiscal first-quarter 2009 (to end-September 2008), photonic component, module and subsystem maker Oplink Communications Inc of Fremont, CA, USA has reported revenues of $43m, down on $49m a year ago but up from $37.3m last quarter.

Net loss was $3.4m ($0.16 per share), compared to $791,000 ($0.04 per share) last quarter and income of $1.3m a year ago ($0.06 per share).

However, non-GAAP results (excluding a $4.1m provision for excess and obsolete inventory) saw net income of $3.2m, up from $2.8m last quarter.

"We reported revenue slightly above the outlook we provided last quarter [of $38-42m] and continued to generate cash from operations [of $4.3m]," says president Tom Keegan. Oplink closed the quarter with cash, cash equivalents and short and long-term investments of $146.7m.

"While we remain optimistic about long-term demand for our products, we are cautious about the near-term impact of economic conditions on telecom capital expenditures and our revenue," says Keegan. "We have begun closely controlling expenses to ensure that our costs align with near-term revenue as we enter this challenging period."

For fiscal first-quarter 2009 (to end-December 2008), Oplink expects revenues to fall to $34–38m, yet net loss per share should be cut to $0.03–0.07.

Keegan says that, in the near term, Oplink will continue to work towards future design wins with its traditional passive customers and releasing new, more competitive transceiver designs. "Despite the near-term challenges, we remain confident in the long-term prospects for our business," he adds.

www.oplink.com

Liu stays on as CEO of Oplink to provide continuity during economic slowdown

Oplink Communications has announced that Joe Liu will now not resign his position as CEO at the end of December (as announced in mid-August).

Instead, president Tom Keegan, who was to succeed Liu as CEO, will leave the firm at the end of December by mutual agreement. Keegan had been with Oplink as VP business development and general counsel since 2007, before being appointed president in May.

"We are grateful to Tom for his important contributions to Oplink during his tenure," says Len LeBlanc, chairman of the board. "However, given the current state of the industry, we believe that this is not the right time to undertake a management change and expect that Joe's experience and knowledge will successfully guide Oplink through these times. We are grateful to Joe for agreeing to continue to lead our company," he adds.

Looking at the challenges facing the industry, I feel it is in the best interest of our stockholders that I stay on as CEO to provide leadership continuity

"Looking at the challenges facing the industry, I feel it is in the best interest of our stockholders that I stay on as CEO to provide leadership continuity," says Liu.

IN BRIEF

Bookham receives Huawei's Excellent Core Partner Award

Optical component, module and subsystem maker Bookham Inc of San Jose, CA, USA has received the Excellent Core Partner Award from telecoms equipment maker Huawei Technologies Co Ltd of Shenzhen, China. President & CEO Alain Couder received the award at the Huawei 2008 Core Partner Convention. The award is the fourth vendor recognition that Bookham has received in recent years from Huawei.

"They have been a core optical component and module supplier to Huawei for many years," said Huawei. "We are very pleased with Bookham product performance, the delivery, the service and the support, and we expect to strengthen the cooperation between the two firms," it added.

"With global sales to the world's largest carriers, Huawei is a very important customer for Bookham," said Couder. "Our customers need reliable suppliers who can consistently deliver quality products with short lead times, and add real value with local sales support; we achieve this through the combination of our ownership of core technology and manufacturing facilities, our vertical integration strategy, and our dedicated and committed customer service," he added.

Bookham opened its manufacturing plant in Shenzhen in March 2004, and has since moved assembly of all its telecom products to China. Bookham employs over 1300 staff there, from where it assembles and supplies Huawei with a range of high-end optical components and modules, including 10Gb/s co-packaged laser-modulators, receivers, directly modulated and tunable lasers, and 980nm pumps.

www.bookham.com

Avanex's margin falls more than expected as revenue shrinks 13%

For its fiscal first-quarter 2009 (to end-September), optical communications component and module maker Avanex Corp of Fremont, CA, USA has reported revenue of $45.3m, down 13% on $51.8m last quarter and 17% on $54.7m a year ago.

Gross margin was 17%, down from 31% last quarter and 28% a year ago, and well down on early October's guidance of 20–23%. Net loss was $9.6m, compared with net income of $1.3m last quarter and $45,000 a year ago.

Previously, in fiscal Q4/2008, Avanex's revenue had rebounded by 5% from a previous low of $49.6m in fiscal Q3/2008, driven by an increase in transmission products sales (although this had been boosted by $1.2m of deferred revenue after the settlement of legal proceedings concerning a distribution agreement with former French subsidiary 3S Photonics).

But in early October Avanex said that, for fiscal Q1/2009, it expected gross margin of 20–23% due to: lower revenue of $44–48m (mainly as a result of a market slowdown in Asia as well as pricing pressure); a temporary shift in product mix to lower-margin legacy products (for which Avanex aims to reduce sales); a higher-than-expected double-digit decline in average selling price (ASP) for one of Avanex's highest-revenue products from one particular customer (for a legacy system); and investing in new capacity for key products such as reconfigurable add-drop multiplexing (ROADM) modules and tunable transponders (with R&D expenses also rising slightly to address such growing markets).

"The company is facing some significant challenges in light of the current macro-economic environment," comments interim CEO Giovanni Barbarossa (who replaced former CEO Jo Major in July, when chief financial officer Marla Sanchez also left the firm). "To better position ourselves, we moved quickly last quarter to implement a significant cost-cutting plan to improve financial performance."

In early October, Avanex said that, by the end of October it would cut staffing by about 47 (8% of the workforce that it had at the end of June). The cuts include closing the firm's facility in Melbourne, FL, USA (acquired in July 2007 along with the MSA 300-pin transponder and XFP transceiver business of the Commercial Communication Products Division of Essex Corp) and transferring the product lines, inventory and fixed assets to Avanex's plants in either Shanghai, China or Villebon Sur Yvette, France (where transponder and transceiver transmission products are made, including 40Gb/s tunable transponders). As part of the cost cutting, all of Avanex's executive officers have voluntarily agreed to a 10% cut in salary from October onwards.

For fiscal second-quarter 2009 (to end-December 2008), Avanex expects revenue to fall further to $37–42m (down on $52m a year previously), but gross margin to get no worse, at 17–21%.

www.avanex.com

Barbarossa appointed as president and CEO

Avanex's board of directors has appointed Dr Giovanni Barbarossa as president & CEO, as well as a member of the board. Barbarossa has been interim CEO since replacing former CEO Jo Major in July.

After receiving a B.S. degree in Electrical Engineering from the University of Bari, Italy and a PhD from the University of Glasgow, UK, during more than 15 years in the optical networking industry Barbarossa was a research associate at the UK's BT Labs, a member of technical staff at the USA's AT&T Bell Labs, and has held senior management roles in the Optical Networking Division of Agilent Technologies and in the Network Product Group of Lucent Technologies. He joined Avanex in 2000, and has since spent eight years in technical and operational roles. Before being appointed interim CEO, Barbarossa served as chief technical officer and senior VP.

Barbarossa's knowledge of the firm and industry, his strong relationships with customers, and his performance while interim CEO were key factors in the appointment, says chairman Paul Smith.

"Barbarossa has begun executing on key initiatives aimed at improving financial performance, including reducing the company's cost structure and expediting time-to-market on key product platforms," Smith says. "Giovanni has secured the confidence of the board, our customers, and employees, and we believe that he is the right person to lead Avanex during these challenging times," he adds.

"Avanex has significant opportunities due to its innovative operating model, which combines a low fixed-cost structure with industry-leading technology," says Barbarossa. "We are investing in new development efforts to expand our product portfolio and engaging with tier-1 customers for their next-generation photonic solution needs."

Opnext experiences lull after initial 40Gb/s deployments

For its fiscal second-quarter 2009 (to end-September 2008), optical module and component maker Opnext Inc of Eatontown, NJ, USA has reported revenue of $80.2m, down 4.8% on $84.2m last quarter. Sales of 10Gb/s and above products fell 5.5% to $65.6m (nearly 82% of total revenue), while sales of less than 10Gb/s products fell 6.3% to $9m, and industrial and commercial product sales grew 7.7% to $5.6m.

Specifically, lower sales of XENPAK modules and 40Gb/s (the latter down from $10m to $7m, versus capacity of $13–14m) were partially offset by increased sales of XFP and 300-pin tunable modules.

"40G sales, while disappointing, suggest a typical pattern associated with the deployment of new networking technology," says president & CEO Harry Bosco. "We've experienced significant growth in 40G modules since we first introduced them in 2006. This initial growth occurred during the production and qualification phases of our customers and the early deployment of trial networks," he adds. "Today, our 40G client-side module is qualified in most of the key equipment suppliers of 40G systems." Following the current temporary lull in demand during initial deployment of networks using the new technology, Opnext expects growth to resume as deployments continue.

Gross margin has fallen from 35.2% a year ago and 32.2% last quarter to 30.5%, due mainly to an unfavorable product mix and lower sales volumes outstripping benefits from foreign currency exchange fluctuations and related hedging programs. Non-GAAP net income (excluding $1.5m of stock-based compensation expense and about $700,000 of litigation expense) was $3.3m, down on $4m last quarter and $6.8m a year ago.

"The market generally remained strong, although we began to see some pockets of weakness near the end of the quarter in certain product areas and with certain customers, which we believe was in reaction to the financial turmoil and tight credit markets," says Bosco. In response to the growing economic uncertainty, Opnext has stepped up cost-control efforts. Hiring of new staff has been trimmed to selective positions.

"Looking ahead, we believe that industry fundamentals remain intact and that network demand will continue to drive optical sales, even in a slowing capital expenditure environment," says Bosco. "However, based on discussions with some of our largest customers, we believe that some softness could continue for the next couple of quarters."

Softness could continue for the next couple of quarters

Given the mixed signals in the past quarter (particularly near the end), coupled with a tempered customer view, Opnext has taken a cautious view of next quarter's guidance. For its fiscal third-quarter 2009 (to end-December 2008), it expects revenue to fall 2–10% to $72–78m. Bosco sees continued growth in tunables, but believes that 40G is not going to recover in the December quarter. "We'll see customers push out their 40G orders," he warns.

Nevertheless, Opnext is proceeding toward closing its acquisition of StrataLight Communications Inc of Los Gatos, CA, USA (announced in July, and now expected to close late this year or early next year). The combination of Opnext's device and module technology with StrataLight's subsystem expertise should create new opportunities in the 40Gb/s arena and accelerate development of Opnext's 100Gb/s product family, the firm reckons. "We are looking forward to combining our efforts to provide a broad portfolio of 40G and 100G modules and subsystems," Bosco says.

"We will continue to improve our execution and readiness in high-growth areas of the business such as tunables and XFP modules as well as 40G, which we will believe will rebound in the first half of next year."

www.opnext.com

SEI launches 10G CWDM SFP+ module with internal DFB laser chip

To support market demand for ultra-high-speed data transmission and exchange, Tokyo-based Sumitomo Electric Industries Ltd (SEI) is expanding its 10Gb/s portfolio with the introduction of a coarse wavelength division multiplexing (CWDM) SFP+ transceiver module that uses SEI's 10Gb/s CWDM DFB (distributed feedback) laser diode chip and supports parallel transmission at 80Gb/s (eight channels, from 1470nm to 1610nm).

The 10Gb/s CWDM SFP+ module

SEI's 10Gb/s CWDM SFP+ module.

is MSA compatible and allows up to 48 ports per line card, reducing cost per bit. SEI says the internal DFB laser chip is manufactured using enhanced processes and achieves lower reduced parasitic capacitance than the existing product. The module covers a center wavelength from 1470nm to 1610nm with a 20nm spacing. Since transmission distance is less than 10km, power penalty due to chromatic dispersion can be negligible, so competitive direct modulation can be used, the firm says.

SEI plans to launch the 10Gb/s CWDM SFP+ module on the market in 2009.

www.sei.co.jp

AXT becomes first germanium substrate maker to sign up as charter member of the CPV Consortium

AXT Inc of Fremont, CA, USA, which manufactures gallium arsenide, indium phosphide and germanium substrate and raw materials, has become a charter member of the CPV Consortium, a global industry organization that aims to support the development and long-term success of the concentrator photovoltaics (CPV) industry in providing a low-cost, reliable source of mainstream renewable energy.

Consortium activities are focused on assuring that CPV systems and installations are safe; creating confidence in performance claims; reducing confusion in the market about the technology; and assuring development of an infrastructure for rapid growth.

"Given the importance of alternative energy development and the ongoing technical success in advancing the efficiency and cost-effectiveness of CPV cells, we strongly believe in the consortium's mission to provide a solid foundation and infrastructure that supports every aspect of bringing this promising technology to mainstream applications," says AXT's chairman & CEO Phil Yin.

Multi-junction III-V CPV cells are mostly grown on germanium (Ge) substrates, and offer significantly higher efficiencies than traditional photovoltaic systems. "We are proud to be the first charter germanium substrate member," says Yin, who adds that AXT joins the consortium alongside a distinguished list of companies that the firm knows and respects.

Other charter members include 3M, Concentrix, Emcore, ISFOC, Isofoton, Solfocus and Veeco.

www.axt.com
www.cpvconsortium.org

SEMI and SolarTech partner to identify photovoltaic manufacturing supply chain issues and develop standards

At the Solar Power International 2008 event in San Diego, CA, USA, trade association Semiconductor Equipment and Materials International (SEMI) of San Jose, CA and SolarTech (a consortium of leaders in the solar industry formed by the Silicon Valley Leadership Group to reduce the barriers to solar) announced a collaboration agreement that aims to benefit the US PV manufacturing supply chain (from equipment and materials suppliers through cell/module makers to installers of PV systems, city governments and utilities).

"SEMI's global reach will help SolarTech expand beyond Silicon Valley, and this relationship will help SEMI members and their customers understand overarching supply chain issues and identify critical areas needing improvement," says SEMI executive VP Dan Martin.

"SolarTech's mission is to increase the velocity of PV adoption by developing standards and best practices across the entire value chain," says Doug Payne, director of business operations. "SolarTech/SEMI collaboration expands the value we bring to our respective members, providing critical insight to companies from equipment manufacturer members to system integrators and permitting utilities," he adds.

The memorandum of understanding will focus on the development of standards, especially at the deployment level (where the scope of SEMI Standards ends, and cell and module safety, performance, interconnection, installation and other standards are required). In addition, SEMI brings a diversified community to the collaboration that influences market development and the global supply and demand curve.

● The SEMI PV Group has published a white paper that details its future vision for the PV industry, presenting strategies that the industry can implement to help ensure sustainable and profitable growth. 'The Perfect Industry — The Race to Excellence in Manufacturing' describes the ideal industry characteristics for a high-growth PV industry as well as SEMI policies, program and initiatives designed to achieve them.

The SEMI PV Group was established in January to enhance support to members serving the crystalline and thin-film photovoltaic supply chains. With the input and guidance of the SEMI board of directors and global and regional PV advisory committees in North America, Asia and Europe, the white paper aims to help members and other players form a collective future vision for the industry and facilitate action plans around industry standards, market information, global advocacy, trade events, sustainable manufacturing practices, and other issues. By defining and communicating ideal industry end-states, both equipment and materials suppliers as well as cell and module makers can more effectively prioritize industry-wide initiatives, says SEMI.

The white paper outlines four attributes of the perfect industry: long-term growth; sustained profitability; environmental excellence; and global scope. Each is examined to explain their role in the industry's formation, and to help understand and describe the necessary industry actions required to achieve the greatest impact. Current and potential SEMI policies, programs and initiatives that address each of these attributes are also discussed.

www.pvgroup.org/perfect

SolFocus launches 25%-efficient CPV system for medium- to utility-scale installations

SolFocus of Mountain View, CA, USA says that its latest concentrator photovoltaic (CPV) system (the SF-1100S) achieves panel conversion efficiencies of 25% (up from 18% for its first commercial system — the SF-1000S — launched a year ago), resulting in what is claimed to be the highest energy density and yield for PV systems on the market. The new system is targeted at medium- and utility-scale markets.

The system's scalable design employs rows of reflective, glass-based optics to concentrate sunlight 500 times onto small III-V-based solar cells that have efficiencies approaching 40% (more than twice that of traditional silicon solar cells). Like the smaller SF-1000S, the SF-1100S uses about a thousandth of the active solar cell material compared to traditional PV panels.

SolFocus integrates its CPV panels with a tracking system that continuously aligns the solar array with direct sunlight throughout the day as the sun moves across the sky. The dual-axis tracking technology has been developed specifically for integration with SF-1100S panels, providing a highly integrated and performance-optimized system, the firm says and resulting in energy generation that matches peak demand periods.

Solfocus existing CPV systems at the ISFOC installation in Puertollano, Spain.

"We continue to drive up the innovation curve and down the cost curve by improving the performance of our CPV systems," says SolFocus' president Mark Crowley. "With the efficiency gains from the SolFocus 1100S, our customers benefit from clean, reliable energy with a small land footprint and low lifetime cost," he adds.

"We have now reached the point where CPV technology can be a disruptive force in the industry, with a roadmap to change the way the world sources energy in the future," claims CEO Gary D. Conley.

SolFocus' CPV solar panels are also the only CPV technology listed by the California Energy Commission as being qualified for California Solar Initiative (CSI) incentives. The panels are constructed primarily of readily available and cost-effective materials such as aluminum and glass, resulting in systems that are over 95% recyclable.

The 1100S will be deployed by EMPE Solar in its 10MW utility-scale project in Spain (see below). SolFocus plans to begin work on the project in early 2009 and start delivering systems in mid-2009.

www.solfocus.com

SolFocus & EMPE sign $103m deal for 10MW utility-scale PV project

SolFocus has agreed a $103m (€80m) deal with EMPE Solar to install over 10MW of CPV systems in several sites across southern Spain by the end of 2010. The project will be the largest CPV deployment in Europe, capable of meeting the domestic energy needs of a city of about 40,000 residents, says SolFocus (whose European headquarters are in Madrid).

"CPV, with its high energy density and output, is an ideal solution for the Spanish market, providing more clean, reliable energy with a small land footprint and low lifetime cost," says CEO & chairman Gary D. Conley. "As we continue to drive down costs towards becoming competitive with fossil fuels, sophisticated partners like EMPE Solar will play a critical role in breaking new ground throughout the Mediterranean," he adds.

The deal comes after SolFocus recently completed two utility-scale CPV projects for Spain's Institute of Concentration Photovoltaic Systems (ISFOC). SolFocus says that, through completion of its 500kW part of the 3MW ISFOC project, it demonstrated CPV's ability to scale to aggressive energy production targets while showcasing the overall system reliability and efficiency.

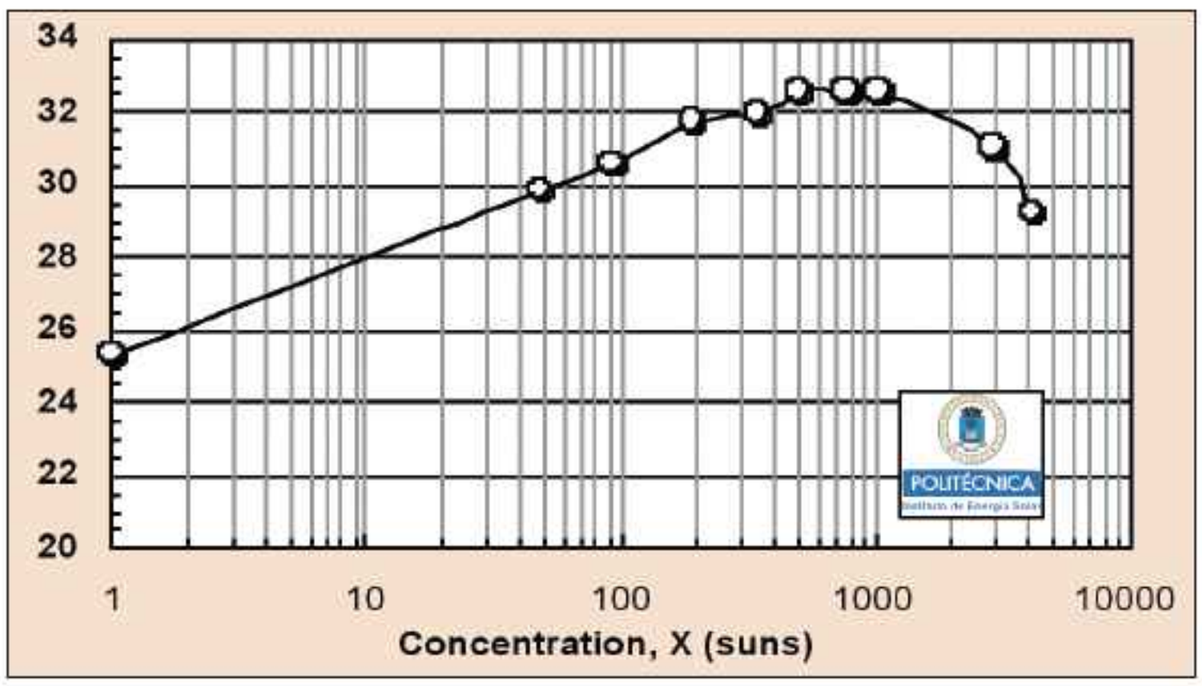
"SolFocus has proven its technology's value in our region, and we are confident it will enable us to quickly achieve our cost targets for carbon-free energy," say EMPE Solar partners Eduardo Goicoechea and Sebastian Sagüés. "CPV technology is targeted to the high solar resource areas of the world," they add.

SolFocus reckons that in its first year of operation the 10MW installation will eliminate the generation of 27,000 tons of CO_2 emissions that would have resulted from traditional fossil fuel energy generation.

Dual-junction PV efficiency record raised to 32.6%

The III-V Semiconductors group of the Instituto de Energía Solar at Universidad Politécnica de Madrid (IES-UPM) in Spain has set a new record for solar energy conversion efficiency of 32.6% for a dual-junction photovoltaic cell.

Designed and fabricated on a GaAs substrate in a horizontal MOCVD reactor by IES-UPM's III-V Semiconductors group, the lattice-matched GaInP/GaAs dual-junction solar cell was independently measured at the calibration laboratory of the Fraunhofer Institute for Solar Energy Systems (FhG-ISE) in Freiburg, Germany. The 32.6% efficiency was measured under light concentration of 1026 suns (where one sun is the amount of light that typically hits the Earth on a sunny day), while at 2873 suns the efficiency is still 31.1%. Professor Carlos Algora, director of the III-V Semiconductors group, says that the new cell is an important advance for terrestrial concentrated photovoltaic (CPV) modules, which use lenses or mirrors to focus sunlight onto the solar cells.



Solar energy conversion efficiency vs concentration factor.

IES-UPM says that its new solar cell differs significantly from the previous record holder, made by Fraunhofer ISE (which, in 2000, achieved 31% at 300 suns). It adds that the new record's importance is not only the efficiency increase of 1.6%, but also the concentration level (1026 suns versus 300 suns). As a rule of thumb, the higher the concentration, the lower the resulting price of the generated electricity. IES-UPM reckons that, after about five years of development, the cost of solar electricity from CPV systems based on this type of solar cell would be about 5.5c€/kWh, while at present the cost of electricity in Spain (generated by any available source: nuclear, oil, coil, gas, renewable etc) is about 7.5c€/kWh.

Algora stresses that this record dual-junction cell represents a step towards improving the efficiency of triple-junction solar cells, for which the efficiency record of 40.8% was achieved under concentration of 300 suns by the US National Renewable Energy Laboratory (NREL). Researchers in the IES-UPM's III-V Semiconductors group think that integration of its dual-junction structure into a triple-junction solar cell could result in a device with efficiencies of more than 41% at 1000-sun concentration.

www.ies.upm.es

Emcore deploys first CPV system in China via XinAo

Emcore Corp of Albuquerque, NM, USA, which makes components and subsystems for the broadband, fiber-optic, and solar power markets, has announced its first deployment of a concentrator photovoltaic (CPV) system in China with the XinAo Group of Langfang (one of the country's largest energy firms).

As part of an agreement reached in April, the 50kW test and evaluation system is fully installed and operational in Langfang, and is producing power in accordance with specifications. Emcore said in April that, once the expected reliability and performance metrics have been demonstrated, XinAo plans to install CPV systems to provide power for its coal gasification project, which is estimated to have a requirement of 60MW (worth $50m).

Also, Emcore and XinAo continue to have discussions regarding the possible construction of a joint-owned plant in China, to manufacture CPV systems designed and certified by Emcore for the coal gasification project as well as the Chinese market.

"We are pleased to introduce the first CPV terrestrial power system in China in partnership with the XinAo Group and look forward to pursuing other solar power opportunities in China's emerging renewable energy market," says Dr John Iannelli, corporate chief technology officer & general manager of Emcore's Solar Power Division.

In early October, Emcore was also granted access permits for its 850kW commercial solar park installation in the Extremedora region of Spain. In addition to these two deployments, Emcore expects several other pilot sites to be deployed by the end of the year.

Emcore's deployed CPV systems are powered by its multi-junction solar cells, operating with 500x concentration. The firm says that it is developing a new 'Generation III' system design — scheduled to be in volume production by second-half 2009 — with enhanced performance (including a module efficiency of about 30%) and much improved cost structure. Emcore says that it has recently responded to several RFPs from public utility companies using Gen-III products as its baseline and expects to receive positive feedback on these proposals by the end of 2008.

www.emcore.com

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First Solar more than doubles revenue & income

For third-quarter 2008, First Solar Inc of Tempe, AZ, USA, which makes thin-film photovoltaic modules based on cadmium telluride (CdTe), has reported revenue of $348.7m, up 31% on $267m last quarter and more than double $159m a year ago.

Despite operating expenses almost doubling from $33.7m a year ago to $65.3m, net income has more than doubled from $46m a year ago (which included a one-time income tax benefit of $7.5m) and $69.7m last quarter to $99.3m.

First Solar has also announced a five-year agreement to supply 100MW of its thin-film solar modules to residential solar installer SolarCity Corp of Foster City, CA, USA, marking First Solar's entrance into the US residential segment. The firm will begin delivering modules to SolarCity in first-quarter 2009.

First Solar is also making a $25m equity investment in SolarCity — part of a $30m round of financing that will fund SolarCity's continued US expansion — with the aim of making solar power an affordable option for more US homeowners and businesses.

SolarCity currently serves more than 300 communities in California, Arizona, and Oregon, but plans to expand into additional states.

The firm says that its SolarLease financing option allows homeowners to switch to solar power for less money than they currently pay for electricity, without the need for a large upfront investment.

First Solar's modules enable SolarCity to serve residential and small commercial markets where solar was not previously an affordable option, the firms claim. "The combination of First Solar's modules with SolarCity's innovative approach to designing, financing and maintaining complete solar solutions enables homeowners and small business owners to lower their electricity costs while reducing air pollution and the effects of global warming," says First Solar's CEO Mike Ahearn. "Our relationship with First Solar will enable us to deliver affordable solar power to a wider market of residential and small commercial customers," adds SolarCity's CEO Lyndon Rive.

First Solar's modules enable SolarCity to serve residential and small commercial markets

First Solar also says that it has entered into new long-term module supply agreements with utility company Sorgenia Solar, a developer of large-scale, grid-connected solar power plants in Italy (and the biggest Italian operator in terms of installed photovoltaic power). With strong market growth in Italy, Sorgenia Solar is well positioned to develop solar power plants in such an important region, comments Ahearn.

In addition, First Solar has extended module supply agreements with several existing customers including EDF Energies Nouvelles, Ecostream, Juwi and Phoenix Solar.

The new agreements with Sorgenia are structured on terms similar to First Solar's existing long-term module supply agreements, and expand its contracted module volume by a total of 525MW, allowing for additional sales of about $800m over 2009–2013.

"These new module supply agreements and contract extensions enable our partners to increase solar electric generation in multiple markets throughout Europe, and demonstrate the successful partnerships First Solar has established with the world's leading project developers and system integrators," says Ahearn.

www.firstsolar.com

Honda Soltec starts selling CIGS PV cells for public and industrial use

After being founded in December 2006 at Honda Motor Co Ltd's Kumamoto Factory and selling its copper indium gallium diselenide (CIGS) thin-film photovoltaic (PV) solar cells for home use in Japan since October 2007, solar cell subsidiary Honda Soltec Co Ltd has begun expanding its customer base by selling solar cells capable of the high-capacity electrical generation required for use by public and industrial facilities.

Honda Soltec says that it is expanding its product line in response to rising demand for not only private use but also public and industrial use due to the increasing awareness of environmental issues. With staffing of about 150 at full production, Honda Soltec's annual CIGS PV module capacity is about 27.5MW (equivalent to 3kW systems for about 9000 homes).

Honda Soltec's CIGC PV factory.

Honda Soltec's HEM115PA and HEM125PA CIGS PV modules for home use have maximum power outputs of 115W and 125W per module, respectively (for solar radiation of 1kW/m^2 at 25^{o}C and an air mass of 1.5).

Likewise, the 115W HEM115PSA and 125W HEM125PSA for public and industrial applications also measure 141.7cm x 79.1cm x 3.7cm and weigh 14.3kg. However, the nominal open-circuit voltages are 92.7V and 93.3V, respectively, for the new modules, versus 278V and 280V for the home-use modules.

http://world.honda.com/HondaSoltec

Sunovia recruits former US Energy Secretary and Under Secretary of Commerce as advisors

Sunovia Energy Technologies Inc of Sarasota, FL, USA has added two senior advisors to its advisory board. Spencer Abraham (US Energy Secretary in 2001–2005 and Senator in 1995–2001) will provide strategic advice and assistance. Kenneth I. Juster (US Under Secretary of Commerce in 2001–2005, in charge of the Bureau of Industry and Security) will provide strategic counseling and assistance on issues relating to public policy and international commerce.

Abraham is chairman & CEO of Washington DC-based consulting firm The Abraham Group of LLC, which specializes in assisting clients seeking opportunities in the international energy sector. Juster serves on the President's Advisory Committee for Trade Policy and Negotiations, and will help to navigate and execute policies and procedures associated with exporting solar, infrared and LED products. "His deep understanding of the global marketplace and expertise in public policy will facilitate and help accelerate many aspects of our continued growth," reckons CEO & chairman Carl Smith.

Sunovia is commercializing single-crystalline cadmium telluride-on-silicon (CdTe/Si) solar cell as well as mercury cadmium telluride (HgCdTe) infrared technologies. In exclusive partnership with infrared sensor and imaging firm EPIR Technologies Inc of Bolingbrook, IL (in which Sunovia has a stake), the firm discovered a method to produce single-crystalline CdTe/Si more rapidly than ever achieved before in any lab, even for a single isolated sample, it claims.

Sunovia expects its solar energy system to achieve grid parity at a production level of 100MW. It will begin marketing it by the end of 2008, and aims to pre-sell its entire production capacity through 2014.

"Abraham's commitment to Sunovia is a clear representation of the progress and innovations that we are achieving," claims Smith.

"The future of US energy policy will be based on our country's ability to develop and implement many different types of technologies to meet our growing energy needs," says Abraham. "Sunovia's new solar energy system is a transformative technology with great potential," he adds. "Sunovia is an impressive company that will be a major player in the solar industry."

www.sunoviaenergy.com
www.epir.com

Global Solar's CIGS PV module earns IEC certification

Global Solar Energy Inc of Tucson, AZ, USA, which makes thin-film copper indium gallium diselenide (CIGS) photovoltaic cells for both glass modules and flexible substrates, has been awarded the International Electrochemical Commission's IEC 61646 certification for its modules.

Delivered by the Arizona State University Photovoltaic Testing Laboratory (ASU-PTL), the certification confirms that the modules adhere to the IEC's requirements for functional and mechanical capabilities for long-term operation and open-air environments.

The IEC sets international standards for all electrical, electronic and related technologies. IEC 61646 'Thin-film terrestrial photovoltaic (PV) modules – Design qualification and type approval' is a test standard used worldwide to verify that new solar modules and the encapsulation materials and manufacturers of solar modules meet a minimum set of functional and mechanical requirements to prove confidence for claim of long-term (+20 year) module performance integrity.

"The IEC module certification process is a series of rigorous tests that simulate what can happen over time to an installed module," says chief technology officer Dr Jeff Britt. "The company's CIGS solar modules have been subjected to the IEC battery of tests and passed the first time," he adds. "At our request, the ASU-PTL subjected Global Solar's CIGS modules to these tests, which are designed to emulate the real lifetime environment of a solar module."

Global Solar Energy currently produces PowerFlex Solar Strings, which provide a pre-connected format to its CIGS cells that enable product designers and module manufactures to quickly and easily benefit from the low-cost, highly efficient and flexible nature of CIGS. The firm's CIGS cells are produced on a bendable substrate, providing manufacturers with flexible solar material that is adaptable in shape and size, opening the door for new and innovative designs in the growing building integration markets.

Global Solar claims to be the only CIGS manufacturer in full-scale production on a flexible substrate. "This certification of our solar product is a huge win for the CIGS industry," says CEO Mike Gering.

● Global Solar gave product demonstrations at October's Solar Power International 2008 event in San Diego, CA, USA. Also at the event, Britt participated in the panel session 'The Great Thin Film Debate: Winning the Hearts and Minds of System Installers and Investors', along with fellow panelists including Harin Ullal of the US National Renewable Energy Laboratory (NREL); Sharp's Paul Wormser; Paula Mints of Navigant Consulting Inc; and Winfried Hoffmann of Applied Materials GmbH & Co KG in Germany.

www.globalsolar.com

Solutions don't solve droop controversy

Indium gallium nitride light emitting diodes suffer a nasty fall-off in efficiency as the current through the device increases. Although some companies say they have solved the problem, debate about the cause continues. Dr Mike Cooke reports on some recent developments.

The world has been promised general lighting based on nitride semiconductor light emitting diodes (LEDs) for some time. The aim is to produce illumination with high efficiency compared with tungsten and even compact fluorescent light bulbs. Nitride semiconductors produce light at the higher-energy end of the visible spectrum from green through to ultraviolet. Combined with suitable phosphors, packaged devices can produce white light. But one barrier to this is finding suitable semiconductor structures that can efficiently support high-power light emission.

Semiconductor light-emitting devices depend for their operation on the ability of electrons and holes to recombine, with the resulting energy reduction of the system being compensated by photon emission (Figure 1). There are also a number of competing processes where, instead of producing light, the semiconductor system itself absorbs the energy released and (eventually) heats up. One route, the Shockley–Read–Hall (SRH) mechanism, is through intermediate levels (recombination centers) in the energy band gap. Such levels result from impurities and defects in the semiconductor crystal structure. Surface and interface states are other routes to non-radiative recombination.

Traditional nitride-based LEDs have a single active layer where the holes and electrons recombine to emit photons (Figure 2). One approach to increasing the light output is to make the active layer thicker. Unfortunately, such thicker-layer double heterostructure devices are difficult to produce with suitable properties and sufficient quality for efficient photon emission.

An added complication in producing InGaN LEDs is that magnesium is the material used to create the p-type material that is the source of the holes injected into the active region. Where Mg is present, electron–hole recombination tends to be non-radiative. Active layers are usually undoped. Many devices use an extra barrier layer to block electrons from reaching the luminance-killing Mg in the p-GaN region or even the top contact.

Rather than having one thick layer of doubtful quality,

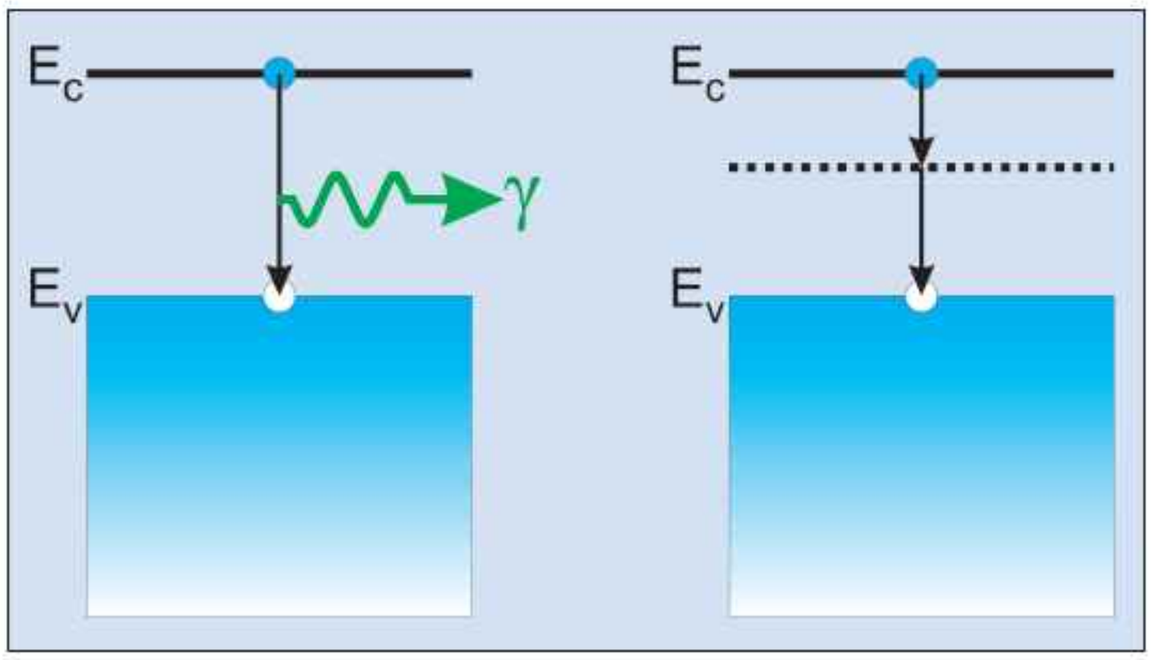

Figure 1. The recombination of an electron and a hole can occur either with the production of a photon (left) or through interaction with an intermediate state (right).

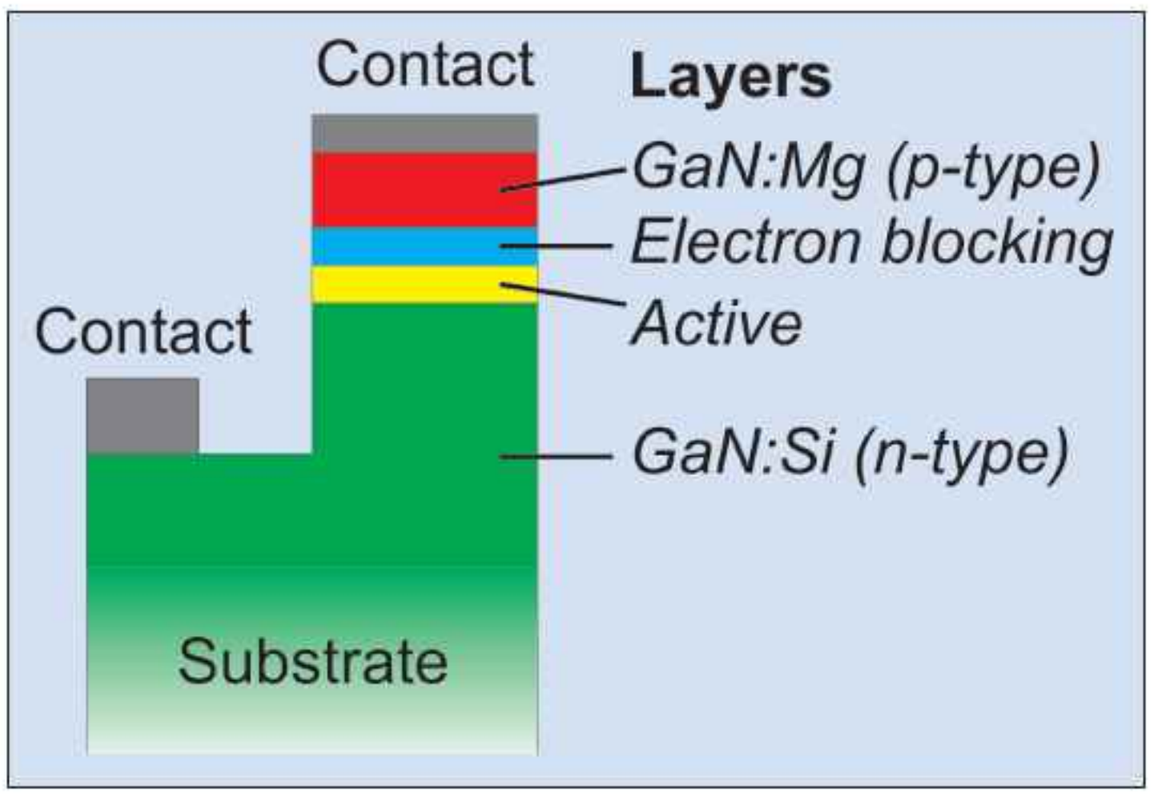

Figure 2. Schematic diagram of a single-layer InGaN LED.

devices have been produced based on multi-quantum wells (MQWs) with a number of thin high-quality active layers (Figure 3). However, the problem with MQW InGaN LEDs is that, above a certain current density (typically 10A/cm^2, or about 50mA current for typical sized devices), the light output external quantum efficiency falls off or 'droops' (Figure 4).

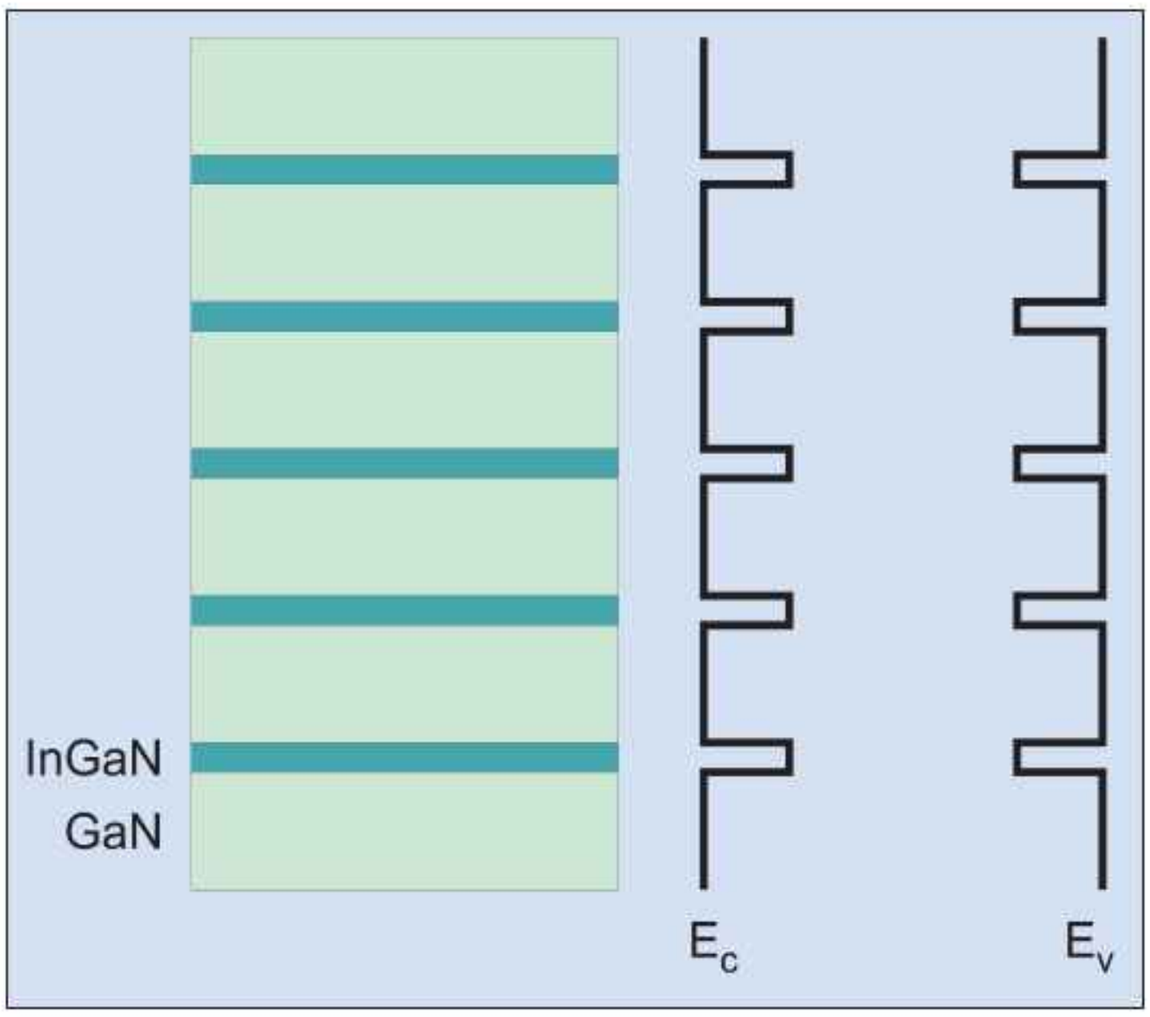

Figure 3. Multi-quantum well structure with an idealized band structure. In reality, polarization fields and other effects drastically modify the potential.

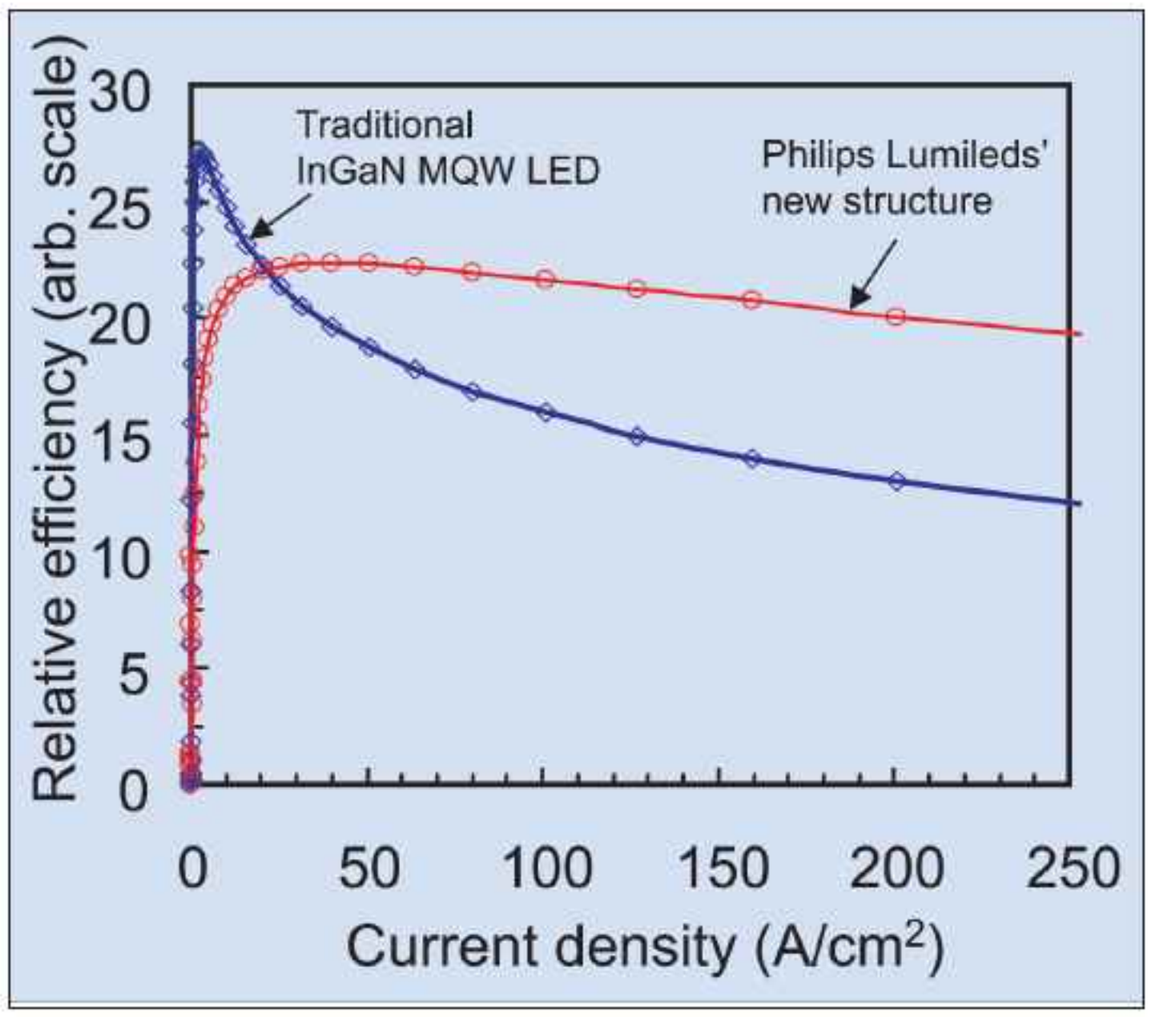

Figure 4. Efficiency versus current density for traditional MQW devices shows a peak and a droop. Also shown is the behavior of a double heterostructure device developed by Philips Lumileds.

Auger controversy

Auger recombination is a third route to recombination that has been proposed as a solution to the puzzle of the efficiency droop. Auger recombination transfers the energy released to another carrier rather than a photon (Figure 5). This third carrier, either an electron or hole, then loses energy to the lattice through a series of scattering events. This sort of process becomes more likely as the carrier concentrations increase. As a rough guide, the Auger rate is expected to increase as n^2p or np^2, where n and p are the electron and hole concentrations. As increased current in a light-emitting device leads to increased carrier concentration in the active region, one expects that Auger recombination will become an important loss factor at some stage.

Philips Lumileds is among those that believe that Auger recombination is the source of the efficiency droop effect [1]. To determine the relative importance of Auger recombination, company researchers performed photoexcitation experiments on quasi-bulk InGaN layers rather than quantum wells to avoid complications such as polarization fields and interface effects (more on these below). Assuming equal electron and hole populations, the recombination rate was modeled as a series of powers of the carrier concentration, with the first power being interpreted as SRH recombination, the second being radiative recombination, and the third being the Auger term. The coefficient of the third power was determined to be in the range $1.4–2.0x10^{-30}cm^6/s$.

The paper comments: "An Auger coefficient of this magnitude provides the dominant mechanism behind the drop in quantum efficiency for a state-of-the-art c-plane InGaN/GaN QW LED at relatively modest current densities."

Philips Lumileds calculations on an InGaN/GaN 2.5nm quantum well with a recombination thickness of ~1nm (less than half the physical thickness due to electron–hole separation caused by polarization fields) suggests that carrier densities of $4–5x10^{18}cm^{-3}$ are achieved at current densities of the order $5–15A/cm^2$. At this density level, according to Philips Lumileds, Auger recombination is the dominant recombination path. The carrier density that is used depends on the observed fact [2] that the radiation from MQW devices

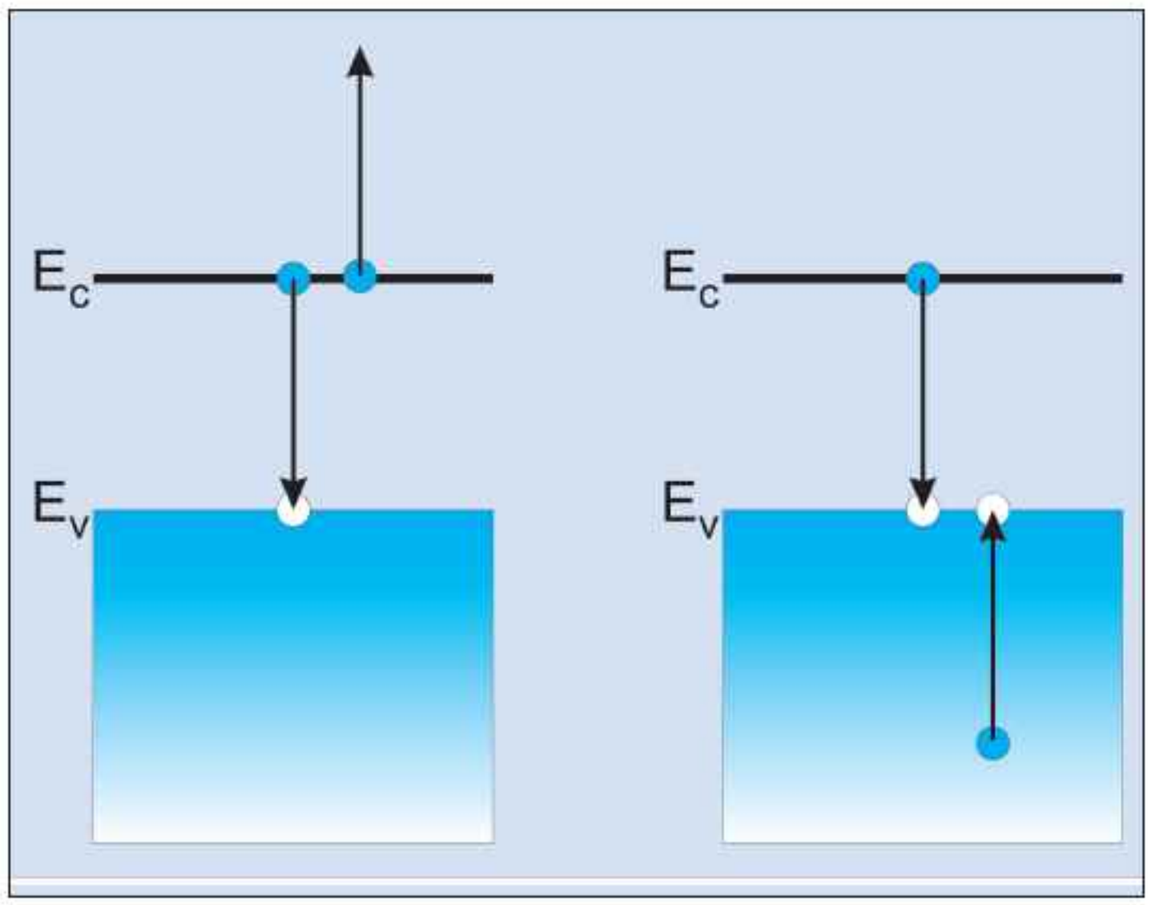

Figure 5. Auger recombination where released energy is transferred to another carrier — either an electron is thrown high into the conduction band (left) or a hole is created deep in the valence band (right).

predominantly comes from the well that is nearest to the p-type region. This means that most of the structure is inactive. So, although the devices are designed as multi-wells, they are effectively operating as single wells, defeating the purpose of constructing the MQW.

On the basis of its work, Philips Lumileds announced in February 2007 that it had 'solved' the droop problem, and that new technology would be implemented in the company's products later last year (Figure 4). From the technical papers issued by the company after this announcement, it appears that this technology is based on using a thicker double heterostructure active layer rather than an MQW to overcome the droop effect [3].

However, not all researchers agree that Auger recombination is the cause of efficiency droop. Theoretical calculations [4] using fully microscopic many-body models find direct band-to-band Auger losses in InGaN MQWs to be negligible. The models use only well-known basic material parameters and describe, within the statistical scatter of the experiments, the performance of more traditional GaAs-based devices applied in the telecom industry.

The paper also points out that the power-law dependences assumed by Philips Lumileds are not those seen in the operating conditions of these devices but rather linear and square dependences for radiative and Auger recombination, respectively.

To show that the model also gives sensible results for GaN-based devices, it is compared with the behavior of InGaN laser diodes, and the results fall within the experimental scatter. Many critics of the Auger hypothesis point to the fact that InGaN MQW lasers need high injection levels for laser action. If an Auger recombination mechanism were important, such devices should not lase at all, they suggest.

Auger supporters retort that the Auger recombination mechanism is one of the few ways to understand the simultaneous high threshold voltage along with high slope efficiency once lasing is achieved. Above threshold, extra injected carriers are quickly converted into stimulated emission, pinning the carrier densities in the active layers and thus pinning the Auger losses as well. Auger supporters also go further and criticize those who adduce carrier injection problems as the source of the droop (see below) by saying that such problems would also afflict lasers, since a large fraction of the carriers would not be available for stimulated emission, because they would not be able to enter the active layer at all.

Auger assistance

Surprisingly, one of the participants in the group behind the work in [4] — consisting of researchers from the University of Arizona, Philipps Universität Marburg and Osram Opto Semiconductors — has been reported as supporting Philips Lumileds' views on the efficiency droop [5]. The apparent turnaround came during a presentation by Osram Opto Semiconductors' Matthias Sabathil at the 2008 International Workshop on Nitride Semiconductors (IWNS). On the basis of "an extensive number of experiments", Osram has come to the conclusion that any presently known physical effect other than an Auger-like loss can be ruled out as the dominant mechanism for the high-current droop of InGaN LEDs.

The LED efficiency droop mechanism proposed is not direct Auger recombination, since that is ruled out by [4], but is rather phonon-assisted — i.e. it taps into energy from lattice vibrations. The experimental work suggests an Auger-like cubic term being responsible for the non-radiative losses. However, theorists on the team have only recently started work on whether a phonon-assisted effect can fully explain these results.

One of these theorists, Jörg Hader of the University of Arizona and Nonlinear Control Strategies Inc of Tucson, comments: "Early indications are that these phonon-assisted losses can be larger than the classical direct ('intrinsic') Auger effect, but we cannot say yet whether they might really be important for the droop.

"I believe that we also have to look into the possibility of density-activated defect-related processes. One idea is based on how lasers operate: at low densities the radiative recombination occurs in high-quality crystal regions, but at higher densities carriers start to spill over into the grain-boundary regions where defect recombination is higher. This density dependence (no loss up to a given density and then a strong linear or higher-power increase for higher densities) might well fit the dependence observed at Philips Lumileds and others. So far, all of this is just a hypothesis."

Easing hole navigation

Virginia Commonwealth University is among those criticizing the Auger hypothesis [6] on the basis of [4], InGaN laser diode behavior, and from the behavior seen in their work. The Virginia group believes that the problem instead arises from the difficulty that the heavy-mass holes have in navigating the MQW structure. In GaN, the (heavy) hole has an effective mass of about 1.4 times that of an electron in a vacuum (m_0), but the electron effective mass is ~$0.2m_0$.

Virginia's most recent work [7] focuses on creating the conditions for a more even spread of holes through the MQWs, thus increasing the effective active region, for example by reducing the thickness of the barrier ($In_{0.01}Ga_{0.99}N$) from 12nm to 3nm, allowing better hole penetration. The $In_{0.14}Ga_{0.86}N$ wells measure 2nm. The current density of the peak external quantum efficiency shifts up from 200A/cm^2 to 1100A/cm^2 for the thinner barrier (Figure 6). The photon wavelengths produced were in the range 400–410nm.

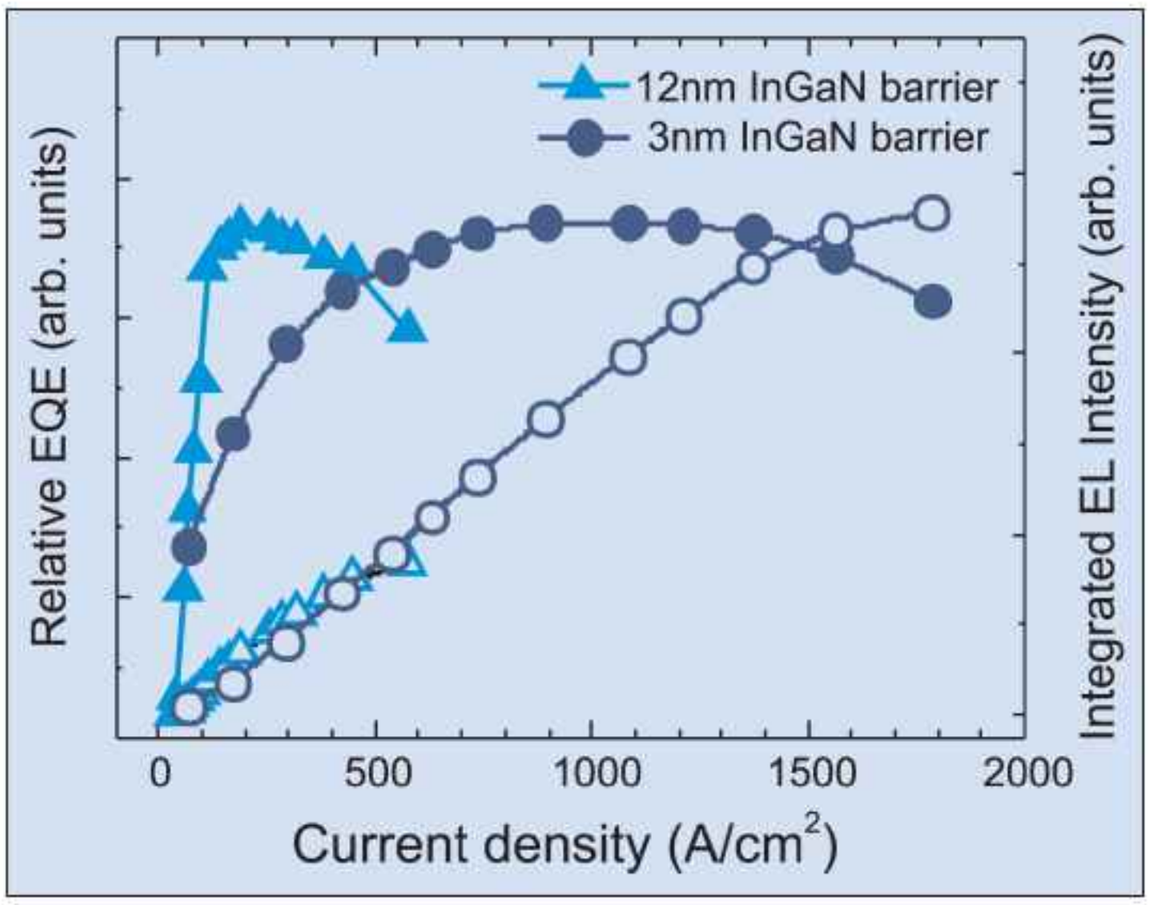

Figure 6. Efficiency (closed symbols) and integrated electroluminescence intensity (open symbols) versus current density for Virginia Commonwealth University devices with 12nm and 3nm barriers.

One notices that the droop current densities quoted by Virginia, even for its comparison device, are an order of magnitude higher than the tens of A/cm² quoted by other groups. Professor Hadis Morkoç, leader of the Virginia group, attributes this to the use of an electron-blocking layer. In testing the devices, a 10μs pulsed current (1% duty cycle) is used to avoid effects from the heating up of the device. Thermal effects reduce the peak current density. Many of the other groups also use pulsed currents in their testing for the same reason, however.

While some of the Virginia devices with 3nm barriers drooped after 1100A/cm², others maintained their efficiency at a nearly constant value up to 2000A/cm². It is thought that a degraded top ohmic contact was responsible for the early decline in some of the devices. With proper optimization of the contact, the researchers believe that efficiency droop effects could be pushed beyond 2000A/cm².

Model calculations on the thick-barrier structure suggest that the hole concentration near the p-type top layer is around seven orders of magnitude higher than that near the n-type side for the thick barrier (Figure 7). For the thinner barrier, the holes become much more evenly distributed through the structure.

Previous work at Virginia involved the creation of five blue-light emitting InGaN MQW structures [6], which explored various designs to increase the hole concentration throughout the MQW, such as lowering the barriers by using $In_{0.01}Ga_{0.99}N$ rather than GaN or by doping the barriers with Mg to spread the holes more evenly through the device. Although the MQW with doped barriers showed the highest EQE peak, it is not really a suitable structure for producing high-brightness LEDs, since the Mg in the barriers tends to diffuse into the wells, killing the luminance.

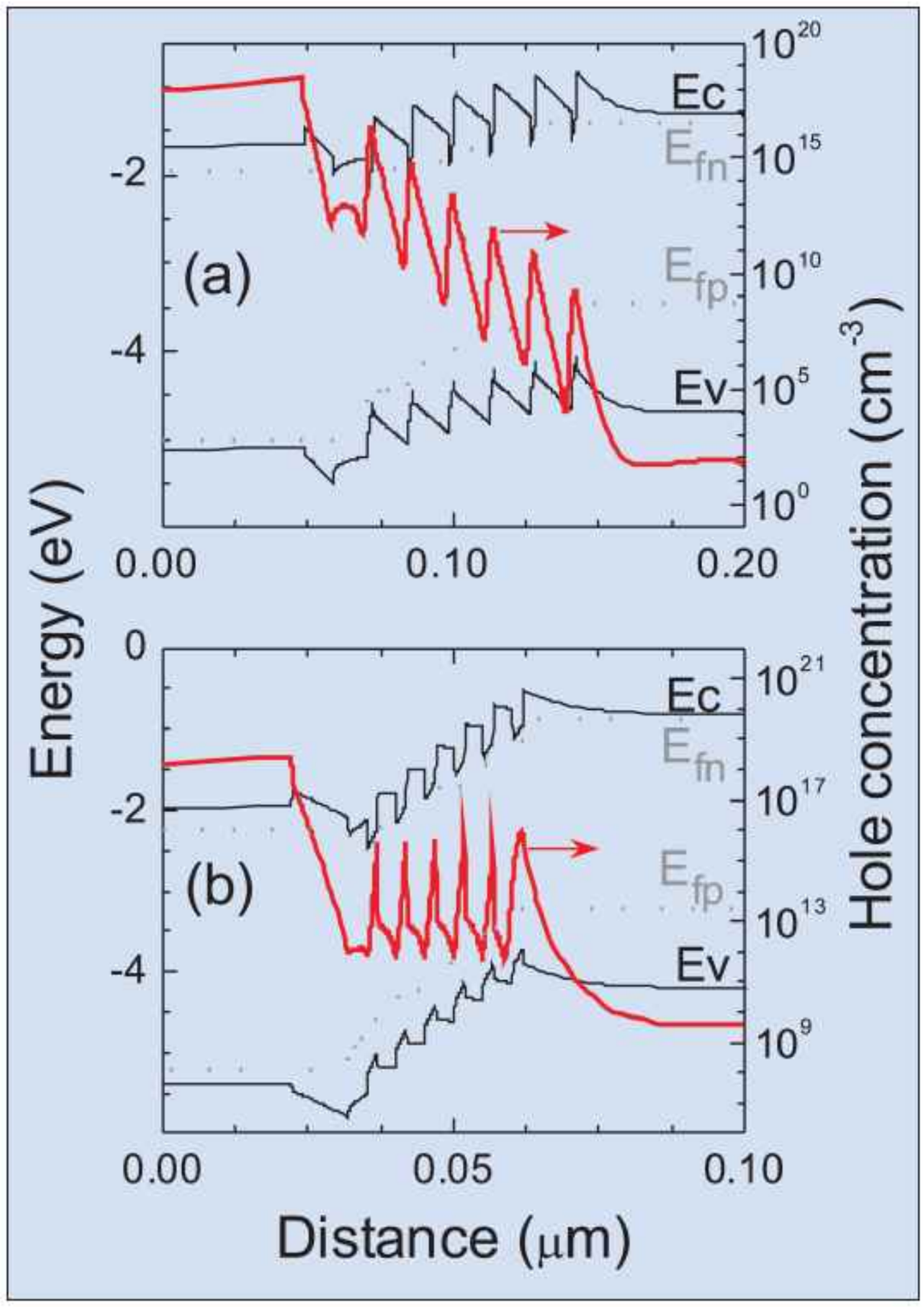

Figure 7. Model calculation of energy band structure and hole concentration distribution for MQWs with 12nm (top) and 3nm (bottom) barriers, as used by Virginia Commonwealth University.

Like Philips Lumileds, Morkoç also sees thicker-layer double heterostructure LEDs as another route to better InGaN LEDs.

Other groups believe that electron transport is the problem. Rensselaer Polytechnic Institute (RPI) and Samsung Electro-Mechanics researchers point out that the interfaces between the AlGaN commonly used as an electron-blocking layer and the GaN barriers between wells have a positive sheet charge [8]. This charge reduces effective barrier heights for electrons. The RPI–Samsung group has compared the performance of GaInN/GaN and GaInN/AlGaInN well–barrier structures with AlGaN electron-blocking layers. The quaternary AlGaInN LED is designed to reduce polarization charges throughout the structure. The efficiency peak of the traditional structure is less than 5A/cm², while that of the quaternary device is at 22A/cm². While the peak efficiency of the quaternary device is less than 70% of that of the traditional structure, its fall-off at higher currents is far less steep, and beyond 50A/cm² its efficiency is greater for the region out to 300A/cm².

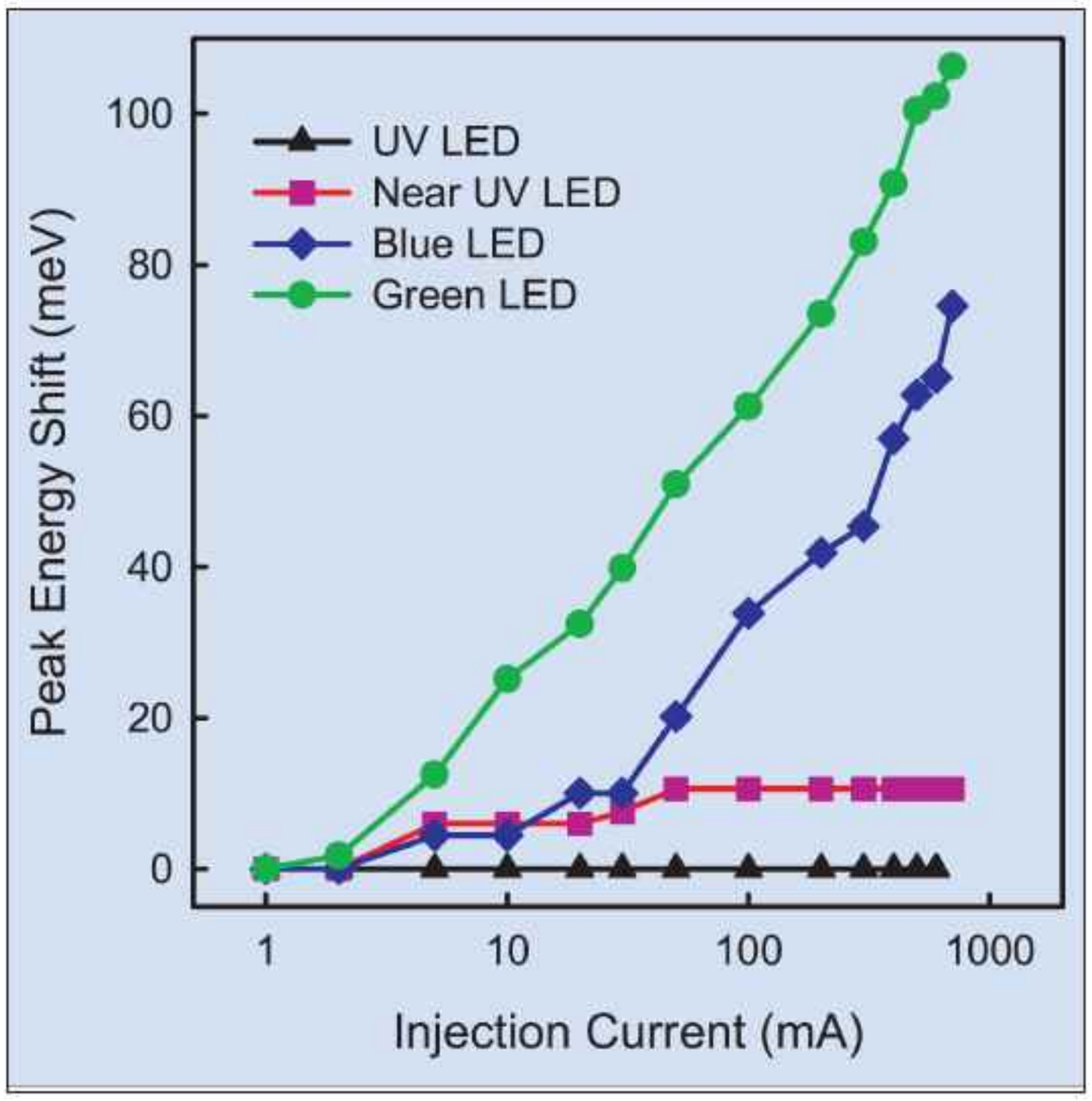

Figure 8. West Virginia University finds that there is a blue-shift in the photon emission for LEDs containing $In_xGa_{1-x}N$ wells with x values of 0.28, 0.17 and 0.09, giving green, blue and near-ultraviolet emission. The UV device had indium-free AlGaN wells.

Indium variation

Researchers at West Virginia University [9] have varied the indium content of MQW LEDs. The peak efficiency current is found to decrease as the indium content increases. At the highest indium concentration, the peak came at 1.4A/cm^2. The $In_xGa_{1-x}N$ wells had x values of 0.28, 0.17 and 0.09, giving green, blue and near-ultraviolet emission. The GaN barriers were silicon doped. The group also performed measurements on an AlGaN MQW LED that showed saturation of efficiency, but no droop as current increases. As the indium content grows, there is a greater blue-shift and broadening of the spectral peak for photon emission as the current increases (Figure 8). By contrast, the UV LED hardly changes its spectral peak as current increases. Pointing to a weak dependence of Auger recombination on material composition [10], the researchers reject this mechanism as the source of the droop.

The West Virginia group interprets the spectral shift as being indicative of localization effects as being the key non-thermal source of the droop in InGaN devices. The emission is seen as taking place in indium-rich regions but, as the local bands fill up when the current increases, the extra electrons go into the conduction band and move to nearby defects where they recombine non-radiatively with holes, killing the radiative efficiency. The researchers see the blue-shift as supporting this conclusion. As the local band fills up, the energy gap between the electron and hole levels increases. UV LEDs radiate through band-to-band transitions and do not have such localization effects.

Growing LEDs on GaN rather than sapphire showed increased efficiencies but continue to demonstrate a droop. This suggests that dislocations are not responsible for the droop. The researchers believe that the defects responsible for the droop are misfits in the wells and at the well/barrier interfaces. The increased indium content creates phase separation and lattice mismatches between the underlying substrate and the quantum well layers, it is believed. ■

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[8] Schubert et al, App. Phys. Lett., vol.93 (2008), 041102
[9] Cao et al, J. App. Phys., vol.104 (2008), 093108
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ETC (Epitaxial Technology Center) developed and customized a SiC process for LPE ACiS M8 and ACiS M10 systems in order to perform the full range of epitaxial layers required for high-power and high-frequency applications, with low cost of ownership.

LPE S.p.A.
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20021 Baranzate (Mi), Italy
Tel: +39 02 383 41 51
Fax: +39 02 383 06 118
www.lpe-epi.com
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LPE is a world leading Epitaxial Technology Company. Based on its silicon epitaxial reactor experience, LPE provides state-of-the-art SiC epitaxial reactors. Two systems are available: ACiS M8 and ACiS M10.

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Fax: +44 1934 837 001
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We provide flexible tools and processes for precise materials deposition, etching and controlled nanostructure growth. Core technologies include plasma and ion-beam deposition and etch, ALD and MBE.

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Fax: +33 (0) 1 39 47 45 62
www.riber.com
Riber is a leading supplier of MBE products and related services for the compound semiconductor industry.

SVT Associates Inc
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www.svta.com

Veeco Instruments Inc
100 Sunnyside Blvd.,
Woodbury, NY 11797, USA
Tel: +1 516 677 0200
Fax: +1 516 714 1231
www.veeco.com

Veeco Solutions for a nanoscale world.™

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7 Wafer processing materials

Air Products and Chemicals Inc
7201 Hamilton Blvd.,
Allentown, PA 18195,
USA
Tel: +1 610 481 4911
www.airproducts.com/compound

MicroChem Corp
1254 Chestnut St. Newton,
MA 02464, USA
Tel: +1 617 965 5511
Fax: +1 617 965 5818
E-mail: sales@microchem.com
www.microchem.com

Power + Energy Inc
(see section 8 for full contact details)

Praxair Electronics
(see section 5 for full contact details)

8 Wafer processing equipment

EV Group
DI Erich Thallner Strasse 1,
St. Florian/Inn, 4782, Austria
Tel: +43 7712 5311 0
Fax: +43 7712 5311 4600
www.EVGroup.com
Technology and market leader for wafer processing equipment.
Worldwide industry standards for aligned wafer bonding, resist processing for the MEMS, nano and semiconductor industry.

Logitech Ltd
Erskine Ferry Road,
Old Kilpatrick,
near Glasgow G60 5EU,
Scotland, UK
Tel: +44 (0) 1389 875 444
Fax: +44 (0) 1389 879 042
www.logitech.uk.com
Logitech Ltd is a leading designer and manufacturer of precision bonding, cutting, lapping, polishing and CMP equipment.

Oerlikon Wafer Processing
10050 16th Street North, Suite 100,
St. Petersburg, FL 33716,
USA
Tel: +1 727 577 4999
Fax: +1 727 577 3923
www.oerlikonoc.com

Oxford Instruments Plasma Technology
(see section 6 for full contact details)

Power + Energy Inc
(see section 8 for full contact details)

SAMCO International Inc
532 Weddell Drive, Sunnyvale, CA,
USA
Tel: +1 408 734 0459
Fax: +1 408 734 0961
www.samcointl.com

Surface Technology Systems plc
Imperial Park, Newport NP10 8UJ,
Wales, UK
Tel: +44 (0)1633 652400
Fax: +44 (0)1633 652405
www.stsystems.com
A leading manufacturer of plasma etch and deposition equipment, including DRIE, ICP, RIE & PECVD technologies used in the fabrication and packaging of semiconductor devices.

Synova SA
Ch. de la Dent d'Oche, 1024 Ecublens,
Switzerland
Tel: +41 21 694 35 00
Fax: +41 21 694 35 01
www.synova.ch

Tegal Corp
2201 S McDowell Boulevard,
Petaluma, CA 94954, USA
Tel: +1 707 763 5600
www.tegal.com

Veeco Instruments Inc
(see section 6 for full contact details)

9 Materials & metals

Goodfellow Cambridge Ltd
Ermine Business Park, Huntingdon,
Cambridgeshire PE29 6WR, UK
Tel: +44 (0) 1480 424800
Fax: +44 (0) 1480 424900
www.goodfellow.com
Goodfellow supplies small quantities of metals and materials for research, development, prototyping and specialised manufacturing operations.

10 Gas and liquid handling equipment

Air Products and Chemicals Inc
(see section 7 for full contact details)

Cambridge Fluid Systems
12 Trafalgar Way, Bar Hill,
Cambridge CB3 8SQ, UK
Tel: +44 (0)1954 786800
Fax: +44 (0)1954 786818
www.cambridge-fluid.com

CS CLEAN SYSTEMS AG
Fraunhoferstrasse 4,
Ismaning, 85737,
Germany
Tel: +49 89 96 24 00 0
Fax: +49 89 96 24 00 122
www.cscleansystems.com

EMF Semiconductor Systems Ltd
(see section 6 for full contact details)

IEM Technologies Ltd
Fothergill House, Colley Lane,
Bridgwater, Somerset TA6 5JJ,
UK
Tel: +44 (0)1278 420555
Fax: +44 (0)1278 420666
www.iemtec.com

Power + Energy Inc
106 Railroad Drive,
Ivyland, PA 18974, USA
Tel: +1 215 942-4600
Fax: +1 215 942-9300
www.powerandenergy.com

SAES Pure Gas Inc
4175 Santa Fe Road,
San Luis Obispo, CA 93401, USA
Tel: +1 805 541 9299
Fax: +1 805 541 9399
www.saesgetters.com

11 Process monitoring and control

EMF Semiconductor Systems Ltd
(see section 6 for full contact details)

k-Space Associates Inc
3626 W. Liberty Rd.,
Ann Arbor, MI 48103,
USA
Tel: +1 734 668 4644
Fax: +1 734 668 4663
www.k-space.com

LayTec GmbH
Helmholtzstr. 13-14, Berlin, 10587
Germany
Tel: +49 30 39 800 80 0
Fax: +49 30 3180 8237
www.laytec.de

Optical Reference Systems Ltd
OpTIC Technium, St Asaph
Business Park, St Asaph, LL17 0JD,
UK

Tel: +44 (0)1745 535 188
Fax: +44 (0)1745 535 186
www.ors-ltd.com

WEP (Ingenieurbüro Wolff für Elektronik- und Programmentwicklungen)
Bregstrasse 90, D-78120
Furtwangen im Schwarzwald,
Germany
Tel: +49 7723 9197 0
Fax: +49 7723 9197 22
www.wepcontrol.com

12 Inspection equipment

Bruker AXS GmbH
Oestliche Rheinbrueckenstrasse 49,
Karlsruhe, 76187, Germany
Tel: +49 (0)721 595 2888
Fax: +49 (0)721 595 4587
www.bruker-axs.de

KLA-Tencor
160 Rio Robles, Suite 103D,
San Jose, CA 94538-7306, USA
Tel: +1 408 875 3000
Fax: +1 510 456 2498
www.kla-tencor.com

13 Characterization equipment

J.A. Woollam Co. Inc.
645 M Street Suite 102,
Lincoln, NE 68508, USA
Tel: +1 402 477 7501
Fax: +1 402 477 8214
www.jawoollam.com

Lake Shore Cryotronics Inc
575 McCorkle Boulevard,
Westerville, OH 43082, USA
Tel: +1 614 891 2244
Fax: +1 614 818 1600
www.lakeshore.com

14 Chip test equipment

Keithley Instruments Inc
28775 Aurora Road,
Cleveland, OH 44139,
USA
Tel: +1 440.248.0400
Fax: +1 440.248.6168
www.keithley.com

SUSS MicroTec Test Systems
228 Suss Drive, Waterbury Center,
VT 05677, USA
Tel: +1 800 685 7877
Fax: +1 802 244 7853
www.suss.com

15 Assembly/packaging materials

ePAK International Inc
4926 Spicewood Springs Road,
Austin, TX 78759, USA
Tel: +1 512 231 8083
Fax: +1 512 231 8183
www.epak.com

Gel-Pak
31398 Huntwood Avenue,
Hayward, CA 94544, USA
Tel: +1 510 576 2220
Fax: +1 510 576 2282
www.gelpak.com

Williams Advanced Materials
2978 Main Street,
Buffalo, NY 14214, USA
Tel: +1 716 837 1000
Fax: +1 716 833 2926
www.williams-adv.com

16 Assembly/packaging equipment

Ismeca Europe Semiconductor SA
Helvetie 283,
La Chaux-de-Fonds, 2301,
Switzerland
Tel: +41 329257111
Fax: +41 329257115
www.ismeca.com

J P Sercel Associates Inc
220 Hackett Hill Road,
Manchester, NH 03102, USA
Tel: +1 603 518 3200
Fax: +1 603 518 3298
www.jpsalaser.com

Kulicke & Soffa Industries
1005 Virginia Drive,
Fort Washington, PA 19034,
USA
Tel: +1 215 784 6000
Fax: +1 215 784 6001
www.kns.com

Palomar Technologies Inc
2728 Loker Avenue West,
Carlsbad, CA 92010,
USA
Tel: +1 760 931 3600
Fax: +1 760 931 5191
www.PalomarTechnologies.com

17 Assembly/packaging foundry

Quik-Pak
10987 Via Frontera,
San Diego, CA 92127,
USA
Tel: +1 858 674 4676
Fax: +1 8586 74 4681
www.quikicpak.com

18 Chip foundry

Compound Semiconductor Technologies Ltd
Block 7, Kelvin Campus,
West of Scotland, Glasgow,
Scotland G20 0TH, UK
Tel: +44 141 579 3000
Fax: +44 141 579 3040
www.compoundsemi.co.uk

United Monolithic Semiconductors
Route departementale 128,
BP46, Orsay, 91401,
France
Tel: +33 1 69 33 04 72
Fax: +33 169 33 02 92
www.ums-gaas.com

19 Facility equipment

MEI, LLC
3474 18th Avenue SE,
Albany, OR 97322-7014, USA
Tel: +1 541 917 3626
Fax: +1 541 917 3623
www.marlerenterprises.net

20 Facility consumables

W.L. Gore & Associates
401 Airport Rd,
Elkton, MD 21921-4236, USA
Tel: +1 410 392 4440
Fax: +1 410 506 8749
www.gore.com

21 Computer hardware & software

Ansoft Corp
4 Station Square, Suite 200,
Pittsburgh, PA 15219,
USA
Tel: +1 412 261 3200
Fax: +1 412 471 9427
www.ansoft.com

Crosslight Software Inc
121-3989 Henning Dr.,
Burnaby, BC,
V5C 6P8,
Canada
Tel: +1 604 320 1704
Fax: +1 604 320 1734
www.crosslight.com

Semiconductor Technology Research Inc
10404 Patterson Ave., Suite 108,
Richmond,
VA 23238,
USA
Tel: +1 804 740 8314
Fax: +1 804 740 3814
www.semitech.us

22 Used equipment

Class One Equipment Inc
5302 Snapfinger Woods Drive,
Decatur,
GA 30035,
USA
Tel: +1 770 808 8708
Fax: +1 770 808 8308
www.ClassOneEquipment.com
ClassOne Equipment specializes in buying and selling high quality reconditioned equipment to the Semiconductor and Nanotechnology Industries.

23 Services

Henry Butcher International
Brownlow House,
50–51 High Holborn,
London
WC1V 6EG,
UK
Tel: +44 (0)20 7405 8411
Fax: +44 (0)20 7405 9772
www.henrybutcher.com

M+W Zander Holding AG
Lotterbergstrasse 30, Stuttgart,
Germany
Tel: +49 711 8804 1141
Fax: +49 711 8804 1950
www.mw-zander.com

24 Consulting

WSR Optical Device Solutions
P.O. Box 248, Flemington, NJ
08822, USA
Tel: +1 908 428 4986
www.wsr-ods.com

25 Resources

SEMI Global Headquarters
3081 Zanker Road,
San Jose, CA 95134, USA
Tel: +1 408 943 6900
Fax: +1 408 428 9600
www.semi.org

Yole Développement
45 rue Sainte Geneviève,
69006 Lyon, France
Tel: +33 472 83 01 86
www.yole.fr

event calendar

If you would like your event listed in *Semiconductor Today*'s Event Calendar, then please e-mail all details to the Editor at mark@semiconductor-today.com

11–13 December 2008
IEEE 39th Semiconductor Interface Specialists Conference (SISC 2008)
San Diego, CA, USA
E-mail: kaczer@ieeesisc.org
www.ieeesisc.org

13–17 December 2008
Photonics 2008: 9th International Conference on Fiber Optics and Photonics
New Delhi, India
E-mail: bppal@physics.iitd.ac.in
http://web.iitd.ac.in/~photonics2008

14–17 December 2008
IEEE International Electron Devices Meeting (IEDM 2008)
San Francisco, CA, USA
E-mail: iedm@his.com
www.ieee.org/conference/iedm

9–11 January 2009
LED EXPO (India)
New Delhi, India
E-mail: info@theledexpo.com
http://theledexpo.com

20–22 January 2009
SEMICON Korea 2009
Seoul, South Korea
E-mail: hkim@semi.org
www.semiconkorea.org

21–22 January 2009
Solar Power Generation USA: Driving the Development of Large-Scale Solar Energy Projects
Las Vegas, NV, USA
E-mail: tori.adair@greenpowerconferences.com
www.greenpowerconferences.com

24–29 January 2009
SPIE Photonics West 2009
San Jose, CA, USA
E-mail: CustomerService@SPIE.org
http://spie.org/photonics-west.xml

3–4 February 2009
Concentrated Photovoltaics Summit USA 2009
Santa Diego, CA, USA
E-mail: josh@csptoday.com
www.cpvtoday.com/usa

18–20 February 2009
Strategies in Light 2009
Santa Clara, CA, USA
E-mail: tcarli@strategies-u.com
http://sil09.events.pennnet.com

25–27 February 2009
2nd International Photovoltaic Power Generation Expo (PV Expo 2009)
Tokyo, Japan
E-mail: pv@reedexpo.co.jp
www.pvexpo.jp/2009_eng

advertisers' index

28 February – 3 March 2009
LED CHINA 2009
Guangzhou, China
E-mail: Led@TrustExhibition.com
www.LEDChina-gz.com

4–6 March 2009
PHOTON's 4th Photovoltaic Technology Show 2009 Europe
Munich, Germany
E-mail: ticket@photon-expo.com
www.photon-expo.com/en/pts_2009_europe/pts_2009.htm

8–11 March 2009
15th European Molecular Beam Epitaxy Workshop (Euro-MBE 2009)
Zakopane, Poland
E-mail: mbe09@unipress.waw.pl
www.unipress.waw.pl/mbe09

22–26 March 2009
OFC/NFOEC 2009: Optical Fiber Communication Conference and Exposition and National Fiber Optic Engineers Conference
San Diego Convention Center, CA, USA
E-mail: info@ofcconference.org
www.ofcnfoec.org

13–15 April 2009
6th China International Solar PV Exhibition
Shanghai International Exhibition Center, China
E-mail: nuogaisi2004@126.com
www.ch-solar.com

20–23 April 2009
Photonics '09: 4th International Specialized Exhibition for Laser, Optical and Optoelectronic Technologies
Moscow, Russia
E-mail: es@expocentr.ru
www.photonics-expo.ru

3–7 May 2009
LightFair International 2009
New York, NY, USA
E-mail: info@lightfair.com
www.lightfair.com

17–22 May 2009
6th International Conference on Silicon Epitaxy and Heterostructures (ICSI-6)
Los Angeles, CA, USA
E-mail: organizers@icsi-6.org
www.icsi-6.org

18–20 May 2009
OPTOmism: Photonics for the Green Revolution
Santa Clara, CA, USA
E-mail: OPTOmismAbstract@oida.org
http://opt09.events.pennnet.com

18–21 May 2009
CS MANTECH (2009 International Conference on Compound Semiconductor Manufacturing Technology)
Tampa, FL, USA
E-mail: csmantech@csmantech.org
www.gaasmantech.org

27–29 May 2009
PHOTON's 5th Photovoltaic Technology Show 2009 Asia
Shenzhen, China
E-mail: ticket@photon-expo.com
www.photon-expo.com/en/pts_2009_asia/pts_2009.htm

1–3 June 2009
SEMICON Russia 2009
Moscow, Russia
E-mail: ovyshkvarkov@semi.org
www.semiconrussia.org

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