

lighting, imaging & displays world

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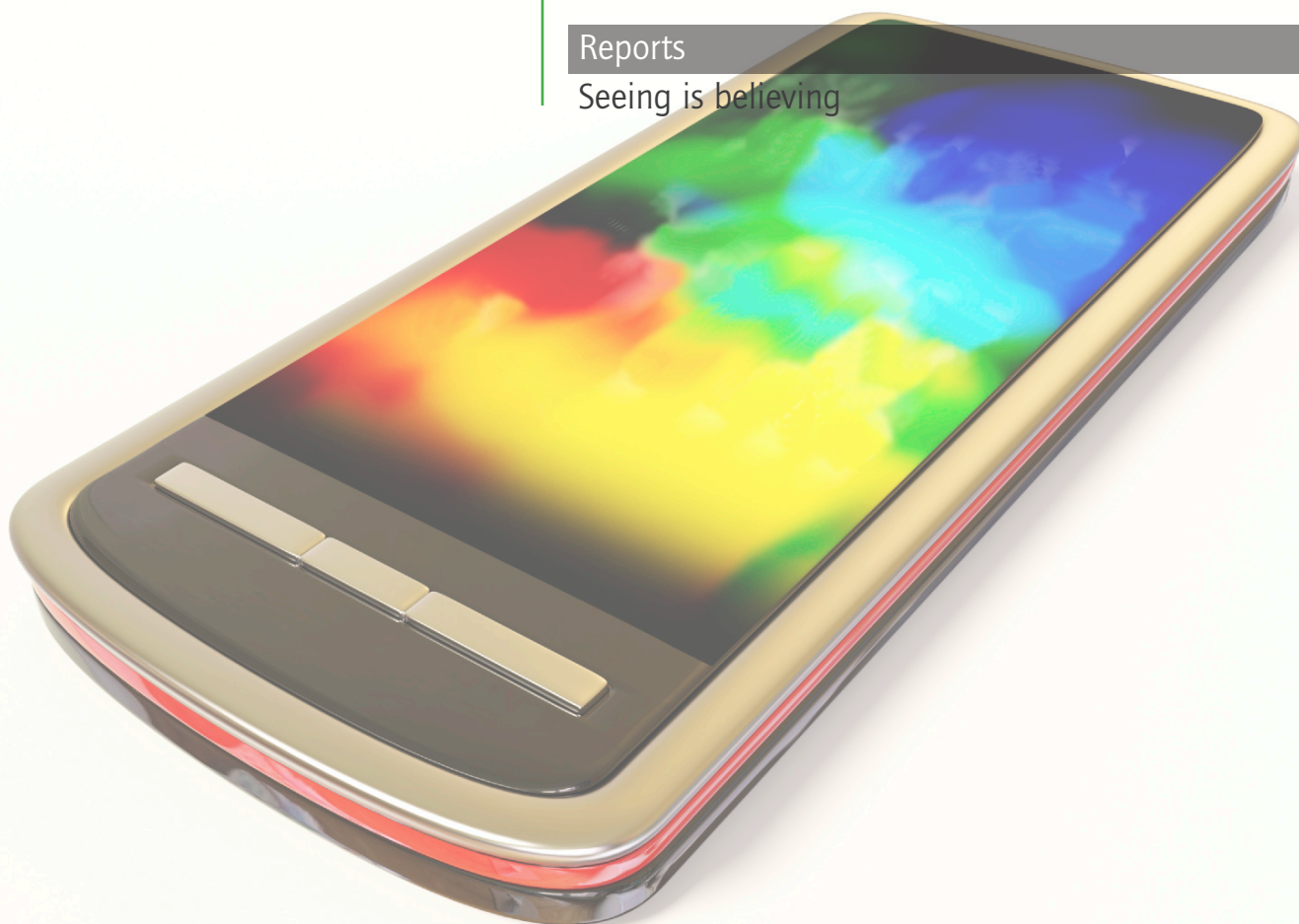
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lighting, imaging & displays world is published 10 times a year. Each issue includes consultancy-level articles that provide independent analysis of the commercialisation of LEDs for illumination, new display technologies for consumer electronics and other imaging applications.

Hitachi looks to join Sony and Toshiba merger

Hitachi is looking to join a mooted merger between [Sony](#) and [Toshiba](#), potentially leading to the creation of the world's biggest LCD producer.

Both Sony and Toshiba have been in talks to bring their two LCD panel businesses together, after the Japanese government-backed investment fund [Innovation Network](#) said it would invest in a merged entity if the two companies could reach an agreement.

Talks are believed to be in the early stages, and it is not yet known if and when any agreement will be concluded. If successful, however, it is expected an announcement will be made later in 2011.

The involvement of Hitachi could allow the group to tip the industry towards the Japanese market. As panel manufacturers compete with South Korean companies on larger panels, firms in Japan have instead focused on smaller displays, like those used in mobile phones and tablets.

Japan's Innovation Network could inject ¥200 billion (€1.7 billion) in the new company for a 70% stake, with the remaining interest split evenly between the partners.

According to data from consultancy [DisplaySearch](#), Sony, Toshiba and Hitachi will have a combined share

of more than 20% of the global market for smaller LCD panels. Of the three, Toshiba had the highest share by shipment value last year (9.2%), followed by Hitachi and Sony.

Japan considers the mobile and tablet display market an area where the country still has a technical advantage over its Asian rivals. It is as yet unclear whether the new company would look at increasing its involvement with larger LCD displays for televisions and other products.

Osram produces high efficiency OLEDs

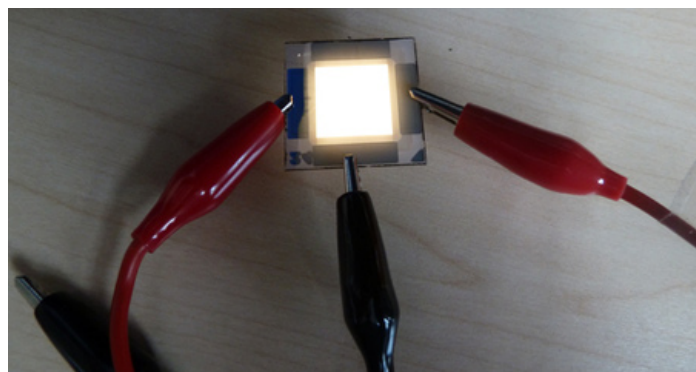
German lighting firm [Osram](#) has announced a new record in OLED lighting efficiency, with a laboratory sample measuring at an impressive 87 lumens per watt. The piece also retained aesthetic and technological characteristics linked to OLED products, such as lifetime and thinness, according to the company.

The sample device was created using organic materials, and prepared using a pure thin-film approach, distributing current evenly across the active surface.

While the test was conducted in a laboratory, there is potential for the higher efficiency OLEDs to progress into products produced by Osram.

Osram's director and general manager of OLED Karsten Heuser comments: 'Our next

Osram's OLED lab tests are expected to aid the development of commercial devices



Source: Osram

step is the launch of our pilot production line for OLED within the next few months. The setup of this is the enabler to produce OLEDs with higher efficiency and brightness for the future commercial market.'

Osram focused on brightness as one of the most significant barriers to making OLEDs commercially viable.

Heuser adds: 'Brightness is a very important factor for the success of OLED. It is also a very difficult design hurdle, as OLEDs should not get too bright, in order to prevent glare.'

'Brightness broadens the OLED application possibilities: it improves functionality, making it an attractive and viable option for various applications.'

As OLEDs compete in some areas of the solid-state lighting market with LEDs, which are also in their infancy, developers are likely to continue pushing the performance specifications of their devices.

Heuser is sceptical about the benefits of going beyond the brightness performance that

has already been established by OLED developers though.

He notes: 'OLED brightness is not limited to 3,000-4,000 cd/m². However the operational lifetime is linked to the actual brightness under operation. Looking from the application side, 3,000-4,000cd/m² is seen as the limit by several light designers, to prevent glare in direct view applications.'

Bridgelux to boost LED lighting in retail

The success of the LED market will rely heavily on the technology being adopted as a display lighting source by the retail industry. That is the view of experts in the industry at the recent [euroLED 2011](#) conference, held at the Ricoh Arena in Coventry, on 8-9 June.

With retail one of the biggest global industries, the benefits for the LED market are vast. Yet the benefits that the technology can offer stores are equal, if not greater in comparison.

Tom van den Bussche, marketing manager for Europe, the Middle East and Africa at [Bridgelux](#), comments: 'At present, at least one in every three new retail designs incorporates LED as a light source. Fashion retailers have a higher uptake on the technology, while it is less adopted in supermarkets.'

'The savings alone in cost make it a highly recommended lighting source. Depending on the prior concept, our research has suggested there could be 30-50% cost reductions, and sometimes more, from using LED lighting.'

Savings depend on what technology was previously installed: Bridgelux predicts LEDs can typically save 50% in cost compared to halogen or high-intensity discharge

Bridgelux is working to increase awareness of the benefits of LED lighting in retail installations, such as the grocery market



Source: Bridgelux

lamp installations, and around 80% for spin density wave and incandescent lighting.

As well as cost savings, LEDs are more suitable for lighting displays because they reduce product degradation. With a reduction in heat output and UV light, store displays can be left unchanged for longer periods.

In fashion, mannequins can go twice as long without the need for clothing changes due to fading.

Similarly in food, LED lighting does not dry out produce such as salads, but the brighter light available can accentuate the colouring of the food, making it more appealing for consumers.

As well as this, displays can be enhanced using simple designs.

According to van den Bussche: 'Dimensional form factors, lighting colour and colour rendering index, amongst other things, can be achieved with the same form factors and fixture designs, and can be incorporated into the shop design. This is not possible with traditional sources, where you will need several different lamp types.'

Bridgelux is aiming to convince more retailers to adopt LED lighting, as van den Bussche explains: 'We are developing product specifications in collaboration with some retail companies.'

'Our RS Array platform was developed in conjunction with [The Manor Group](#) and [RD Leuchten](#), for example.'

'We are also talking to the designer communities and reaching out to retail companies

directly, albeit to a lesser extent, to create awareness of LED.'

Patent challenge on OLED display materials

[Universal Display](#) (UDC) is facing a challenge of its patent in a phosphorous material used in OLED panel creations, which could open the market for other manufacturers.

South Korean firm [Duksan Hi-Metal](#) is challenging the patents, following similar action in Japan earlier in 2011. In that instance, the challenge was to claims made by UDC that were subsequently rejected by the [Japanese Patent Office](#). The overall intellectual property remained valid, but UDC was awaiting a translation of the ruling in English before deciding whether to launch an appeal.

The challenge in South Korea is to the patent itself, and is much more significant.

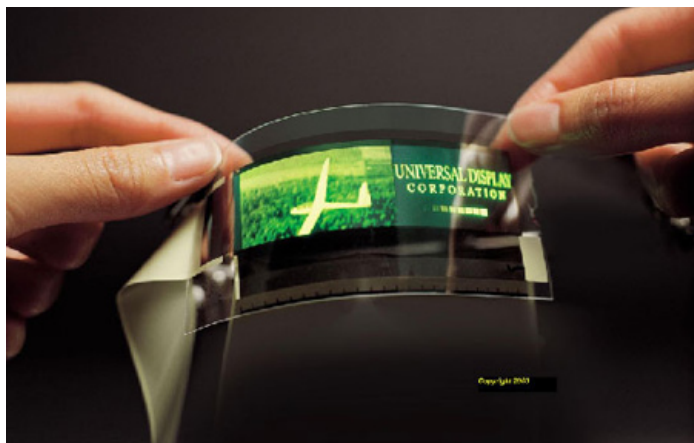
Should the case be successful, companies in the country could use the phosphorous material covered without having to pay royalties to the US company. Manufacturers such as [Samsung](#) and [LG](#) would instead be able to add the materials to their OLED products, which could lower costs.

The patent, which has been taken out in a number of European countries as well as in the US, could see a global challenge if repealed. The material covered allows OLED panels to produce a brighter display and act more efficiently. UDC has announced its intention to appeal, should the ruling go against it.

LED tunnel illuminates London lighting strategy

The first tunnel in the UK to be lit entirely by LEDs has been unveiled by

UDC's patent into phosphorous materials allowing for brighter OLED displays is held worldwide, but could come under scrutiny should the judgement in Korea go against it



Source: UDC

UK government transport association [Transport for London](#) (TfL).

The capital city's tunnel was equipped with 268 strips, comprising of 12,464 LED bulbs, as part of some recent refurbishment work.

Dana Skelley, director of roads at TfL and chair of the [UK Lighting Board](#), comments: 'London has over 50,000 streetlights and 13 tunnels, and that produces a lot of carbon emissions in keeping them lit.'

'We have been looking at new technology for a while to reduce this, as well as looking for something that will reduce the impact on the travelling public.'

'LEDs had the right solution for some time; we just needed to make sure they were suitable for the project.'

The technology is expected to reduce energy consumption by 60% and to reduce CO₂ emissions by 80%

Skelley adds: 'There is also expected to be an 80% reduction in the time spent on maintenance work, which is particularly beneficial for road users who travel through the tunnel regularly.'

While the authority is looking at refurbishing more tunnels to carry full LED lighting, there is a need to monitor ongoing technology improvements before committing, says Skelley.

She remarks: 'The technology is developing all the time and lighting levels are increasing, while lifetime remains the same. We want to be sure than when it comes to working on further

tunnels in the area, we are using the most up-to-date technology.'

Trials are also ongoing with LED street lighting, in collaboration with the [Climate Group](#). Projects on two roads through the city have been underway since November 2010.

TfL plans to start adapting more lights to LED once costs reduce and various obstacles, such as brightness without glare, are overcome.

As with the tunnel installation, different meter arrangements also need to be made for LEDs to work with the existing power supplies installed.

The solid-state lighting strategy contributes towards London mayor Boris Johnson's target of a 60% reduction in the capital's CO₂ emissions by 2025.

Dilitronics moves into Asia

German LED control specialist [Dilitronics](#) is moving into the rapidly expanding Asian marketplace, with the launch of its first non-European office in Hong Kong.

With the continent progressing rapidly with energy-saving lighting concepts, LEDs are seen as the ideal fit in Asia. Dilitronics, based in Jena, Germany, is keen to tap in to this, having seen extremely good sales potentials in LED control solutions.

The company took part in the [Guangzhou International Lighting Exhibition](#) in June, deeming it a success in launching the company's

Aixtron creates Chinese spin-off

Supplier of MOCVD equipment for LED production [Aixtron](#) has opened a wholly-owned Chinese subsidiary, as it plans for further expansion into Asia. Aixtron China replaces the representative office of the company, and operates out of Shanghai.

The company sees the move as a logical step in its increasing commitment to supporting China's efforts in LED production. By establishing a wholly-owned subsidiary, Aixtron can take advantage of any further manufacturing developments in the country, while reducing operating costs and offering a broader range of services. Customers will also benefit from a faster supply of spare parts and customer service.

Bernd Schulte, Aixtron's executive vice president and COO, states: 'We are deeply impressed by China's commitment to introduce efficient lighting with LEDs and taking a leading role. We are fully supportive of our increasing customer base and the government agencies involved.'

The growth in China has seen the company's staffing numbers almost triple over the last two years. The investment comes just a year after the opening of a new R&D centre at its European headquarters in Germany, to drive forward development of the next generation of deposition systems for materials of the future.

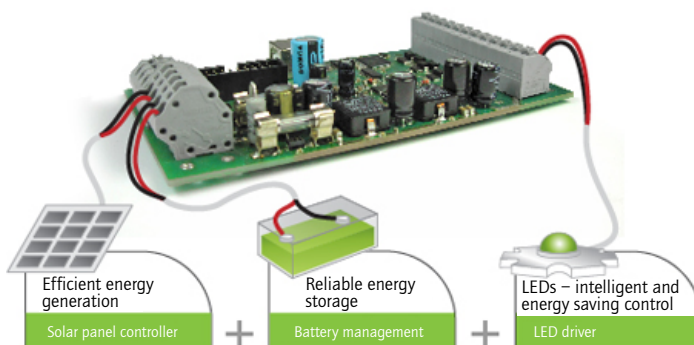
portfolio into the market. One such product Dilitronics is keen to push to the Asian market is the ESoLux 2.0 solar LED controller.

Meinrad Braun, sales director at Dilitronics, explains the technology's benefits: 'This solution is particularly suitable for regions that have no electrical infrastructure.

'The driver manages all of the components – the battery, the LED and the solar panel – so no external power supply is necessary for the street lamp.'

The new office will also aid coordination of the company's volume production in China, as well as supplier management, which had previously been run entirely from Germany.

The ESoLux 2.0 solar LED controller is one product Dilitronics is keen to push in the Asian market



Source: Dilitronics

As the camera becomes an increasingly standard feature for mobile phones, Dave Howell investigates its relevance as a consumer tool

Seeing is believing

The mobile phone market is booming, with estimates claiming there are currently over 5 billion mobile subscribers, or over 70% of the world's population now owns at least one handset.

One of the most important components of mobile phones that continues to grow in popularity is the camera. The growth of social networking websites including [Facebook](#) and [Flickr](#) has widened camera phones' appeal.

Research has consistently shown that consumers would move exclusively to using a camera phone if the quality was high enough, and the camera offered the features of their dedicated digital cameras. The sale of camera phones supports this view.

[Strategy Analytics](#) predicts worldwide sales of camera phones will reach over 1 billion units by the end of 2011. Looking at market segments, the 8MP and above camera phone is predicted to be the most popular, as consumers look to improve the image quality they can obtain when upgrading.

Neil Mawston, director at Strategy Analytics, adds: 'The fastest growing segment of the camera phone market will be the high-tier. We forecast camera phones with sensors of 8MP and above to grow a healthy 240% worldwide during 2011.'

'Smartphone vendors like [Nokia](#) and [HTC](#) are increasingly loading their flagship models with more megapixels to deliver improved imaging

quality for premium operator services like augmented reality.'

What is becoming clear is that the consumer only has a megapixel rating with which to compare the cameras on the mobile handsets they are evaluating, but that they require much more information to make an informed decision. Moreover, an industry saddled with a simplistic approach to camera phone comparison needs to evolve its own metrics if it is to maintain a technological advantage.

Beyond megapixels

'Our main focus over the last few years is to develop a set of measurements that can measure image quality from camera phones,' explains Lisa Walker, president of the [International Imaging Industry Association](#) (I3A).

'The key driver behind the development of our metric was from the developers themselves. It is important to understand that the camera supply chain is very different from other consumer electronics.

'With digital cameras from the leading manufacturers, they make the entire product. With a camera phone, the phone's developers are buying in the camera component, but have no metric to compare the cameras and their components that are currently available to them.'

Even after the metric that I3A is developing has been fully ratified, however, the system is still only voluntary.

Research has consistently shown that consumers would move exclusively to using a camera phone if the quality was high enough, and the camera offered the features of their dedicated digital cameras

Comparing cameras

The use of the megapixel as the only differentiator for consumers and industry members alike has been a hurdle since the digital camera and the smartphone came to the market. However the industry is now actively looking for a universal system, which will not only allow them to compare the camera units they wish to use in their phones, but will offer consumers precise information about the quality of the built-in camera. The Camera Phone Image Quality Initiative (CPIQ) from the [International Imaging Industry Association](#) (I3A) has been developing these metrics for the several years – recently completing its phase three testing.

'Our CPIQ group has worked hard to research and develop the first systematic approach to image quality testing and comparison methods, so that carriers, manufacturers, and consumers can evaluate and choose the right camera phones for their imaging needs,' says Lisa Walker, president of I3A.

'Delivering this set of metrics and the CPIQ rating system provides the first-ever means to easily characterise and compare image quality, and it will yield significant testing cost savings for the image sensors sector and related industries.'

The I3A CPIQ metric, if adopted by the industry, offers a better way to segment product offerings and market the right camera phone to the right customer. The metric will offer a balance across all performance aspects including noise, sharpness and colour into a single, comprehensive result that allows meaningful comparisons to be made.



The I3A has yet to decide on what form the camera phone rating system will take, but these are some of the contenders that could be used to educate consumers

Source: I3A

'One of the main issues with the metric that is being proposed and developed is that it is for voluntary participation. What this could mean is that some manufacturers don't have their handsets tested, or even decline to send some specific models for evaluation. And of course dependent on the findings of that testing, the manufacturer may well decide not to publish those results,' notes Steve Hoffenberg, director of consumer imaging research at [Lyra](#).

One of the most significant issues facing the market is that the phones are often used in low-light environments. For camera phones with small optics this can prove to be challenging. The developments in imaging technology – particularly in lens design and the sensitivity of CMOS chips – will go a long way to alleviating these issues. Additional processing, such as photo editing, is also a proven method that can improve a raw image.

New technology

The camera phone industry as a whole is advancing rapidly, as consumer demand still places the quality and capabilities of the camera in a phone as an important factor in their buying decisions. With limitations due to the form factor of the mobile phone, component manufacturers are focusing their attention on improving each element of the camera phone, from the lens itself to the image-capturing sensor.

A good example of sensor innovation is QuantumFilm from [InVisage](#). QuantumFilm is based on quantum dots with high light-capturing capabilities, making them ideal for CMOS applications.

Together with its QuantumShutter technology, which solves the [rolling shutter effect](#) that can plague some digital cameras, these innovations offer camera phone developers the tools needed to improve camera image quality for handsets.

'It is becoming increasingly difficult and expensive to develop next-generation image sensors using silicon. Essentially, silicon has hit a wall,' says Jess Lee, InVisage president and CEO.

'The fundamental problem is that silicon cannot capture light efficiently, but until now it has been the only option. The disruptive nature of QuantumFilm builds on silicon's success in electronics, and elevates its function using new materials that are engineered from the ground up for light capture.

A radical change from silicon could be a means of achieving greater improvements in image sensing, with silicon struggling to go beyond its current capabilities.

'It is safe to say that the industry spends an average of \$1 billion [€689 million] for each

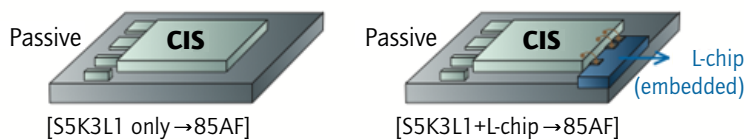


Figure 1

Samsung's S5K3L1 offers 12MP resolution CMOS using 1.12 μ pixel technology

Source: Samsung

new generation of pixel technology, all to achieve a single-digit percentage improvement in image quality,' says Tetsuo Omori, senior analyst, [Techno Systems Research](#).

'The future of imaging is in new materials like QuantumFilm, which will change the competitive landscape and possibly re-ignite the pixel race.'

Slim fit

[Samsung](#) has also recently announced its development of the S5K3L1, which offers 12MP resolution CMOS using 1.12 μ pixel technology. Based on the backside illuminated (BSI) pixel architecture, the imager offers clear and sharp images in low light environments and is optimised for premium feature and smartphones.

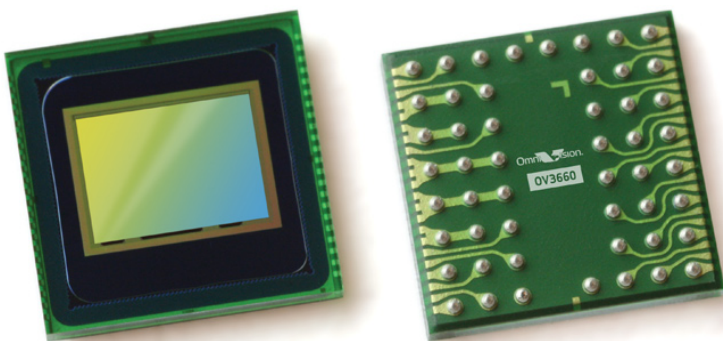
The RGB-white filter feature works in conjunction with a complementary logic chip (S5C73L1), which converts RGB white pattern to [RGB Bayer](#), so it is compatible with the Bayer ISP backend. The logic chip also provides lens shading correction, image down scaling, noise reduction and significantly enhanced modulation transfer function to reproduce fine details.

Figure 2

OmniVision Technologies has developed a CMOS image sensor based on its advanced OmniBSI pixel architecture

Source: OmniVision

Samsung's S5K3L1 imager is designed for slim mobile phones and small form factor applications. 'With extensive experience and technical know-how in the image sensor business, we successfully developed the smallest, 1.12 μ pixel imager,' states Dojun



Rhee, vice president of marketing, for system LSI division at Samsung Electronics.

'With this achievement, we are committed to lead the market by providing the high-quality products demanded by consumers and businesses.'

In May 2011 [OmniVision](#) announced the OV5690, the first 5MP image sensor to use OmniVision's proprietary OmniBSI-2 pixel architecture. The new 1.4 μ backside illumination pixel allows for a full 5MP in a 63.5mm optical format. The device combines strong image quality with a 20% reduction in camera module height, making it effective for slimmer mobile handsets, smartphones and tablet computers.

'With industry sources placing 5MP CMOS image sensors at more than 15% of the overall sensor market today, we view 5MP sensors as occupying as a sweet spot in the market,' remarks Per Rosdahl, product marketing manager at OmniVision.

'Some industry analysts believe that market share may exceed 30% by 2014 [according to Techno Systems Research's '[CCD/CMOS Area Image Sensor Market Analysis](#)'] driven by the demand for higher performance resolution and increasingly slim mobile handsets, smartphone, and tablet designs.'

Stability

Current high-sensitivity MOS image sensors suppress unevenness in brightness. CCDs have low colour-mixing characteristics that suppress colour unevenness. The rapidly expanding market for digital cameras with higher image quality and a slimmer body has resulted in greater demand for a stable supply of image sensors that offer both high sensitivity and uniform picture quality.

February 2011 also saw the announcement from [Pelican Imaging](#) that it had developed the first prototype array camera for mobile devices. Pelican Imaging has developed a computational camera array architecture and fundamental intellectual property with 12 pending patent applications in array optics, sensors, and image reconstruction algorithms.

Pelican's camera improves upon image and video quality, while allowing for thinner smartphones. New applications are also enabled by introducing features such as 3D depth, gesture control, and the ability for users to interact with the image before and after capturing the shot.

Multimedia age

Marc Levoy, professor of computer science at [Stanford University](#) and a member of Pelican's technical advisory board, comments: 'Pelican's technology has the potential to upset the traditional trade-off between the sensitivity and resolution of a camera, and its thickness. It also brings new capabilities to cameras, including post-capture focusing, [foveal imaging](#) and programmable frame rates.'

'Pelican Imaging's high-resolution, wafer-scale cameras will tap into a highly compelling consumer market and enable better camera



phones,' adds William Strecker, executive vice president of architecture and engineering and CTO at [IQT](#) – an investor in Pelican Imaging.

'In a multimedia rich age, this technology has the potential to significantly impact the future of digital imaging, video and photography.'

Figure 3

Prototype camera and software architecture, if perfected, could revolutionise the camera phone market

Source: Pelican Imaging

Q&A – Neil Shah, analyst for wireless device strategies, global wireless practice, *Strategy Analytics*

What level of quality are users looking for from a camera phone?

We are seeing users looking for key features such as higher- megapixel lens to autofocus, faster shutter speed, dual-LED Flash and HD video recording in their camera-enabled phones.

The demand for different features varies across different regions. For example: higher megapixel resolution is particularly popular in markets such as Japan, France, the UK and South Korea.

Will compact digital cameras disappear as smartphone cameras improve and surpass the image quality?

Compact cameras lose out in factors such as lacking wireless connectivity, lack of sophisticated applications like augmented reality, and being an additional expense for consumers' fixed budgets. However, they do hold the advantage of battery life, typically better quality optics, sensors and flash, and strong brand names.

Is the quality of the camera an important factor when consumers buy a new camera phone?

The camera has been one of the important and differentiating factors in a buying decision. With the advent of smartphones, however, other features such as processor speed, operating system, input capabilities and technologies like WiFi or Bluetooth are becoming equally important.

What are the usage trends for camera phone usage?

There is a rising trend in both areas, but the proportion of still photography usage is higher due to ease of use, quick capturing capability, universal portability and ease of sharing real-time, to either social networks or via email or MMS. This is compared to videography, which might require greater memory storage capability and has no universal recording format.

How do you see the camera phone developing over the next few years?

We expect to see the megapixel race continue, but the importance of additional features such as dual LED flash, autofocus, wide angle lens, HD video recording, higher sensitivity and improved low-light photo capture technologies will appear in the future.

We will also see newer technologies such as multi-array-micro cameras, liquid lenses, quantum dots, image stabilisation and full HD 1080p video recording come in as well.



Figure a: Neil Shah

Source: Strategy Analytics

With one of the most important components of any camera being the lens it uses, [Varioptic](#) recently announced its second-generation liquid lens.

The B617 programmable liquid lens is the first offering in the 'Baltic' family of products that integrates optical image stabilisation and autofocus functionality in the same element.

Varioptic's autofocus liquid lenses have been used since 2007 in consumer, medical, military and industrial devices, including full HD DV camcorders, barcode readers, security and biometric cameras, dental cameras, machine vision cameras, and other high-performance products. The new lens compensates for handshake blur and substantially improves low-light image quality.

Camera evolution

Just as the PC industry has been in a race to develop even faster microprocessors in ever-decreasing dimensions, so the developers of camera modules for phones are also in a technological race to develop optics, sensors and processing algorithms that allow improvements in image quality to be made.

The development of the camera module for smartphones in particular is gaining pace with each passing year.

Lyra's Hoffenberg concludes: 'Today we are seeing a market that contains a number of different buying groups. Increasingly consumers are paying more attention to the camera module that is contained in the phones they are evaluating for purchase.'

'The expectation level is broad and changing. At the high end of the market products such as the Nokia N8 have exceeded expectations; reaching a level of image quality that users thought was not possible in a camera phone, with many owners increasingly using it instead of a standalone digital camera,' says Damian Dinning, camera and imaging specialist at Nokia.

'I personally believe we've barely seen anything yet in terms of mobile imaging; there's going to be a massive growth in mobile imaging innovation over the next few years.'

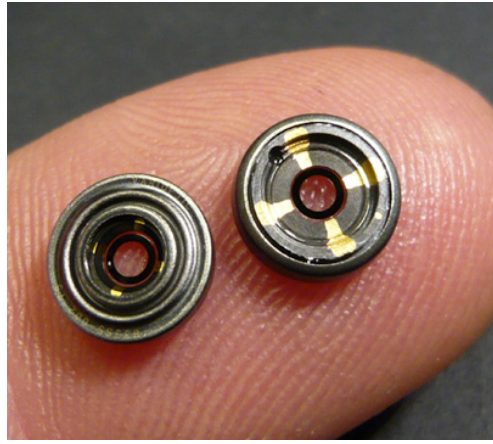


Figure 4

This liquid lens can be programmed to offer high levels of clarity in a wide range of environmental conditions

Source: Varioptic

What was once viewed as an ancillary feature on mobile phones is now gaining in importance. Manufacturers and mobile carriers are all seeing a steady upswing in the sales of handsets that have improved image quality within their cameras.

Whether the rating system being developed by I3A delivers the metrics that the industry is looking for, and that will be adopted by the consumer remains to be seen. However, the reliance on simply measuring and then comparing megapixel rating is not a sustainable system over even the short term ■

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