

## CALENDAR

Date	Subject	Venue	Contact
20-21 September 2010	SID Organic Electronics UK 2010	Imperial College, London	<a href="http://www.sid.org/chapters/uki/forthcoming_meetings.html">http://www.sid.org/chapters/uki/forthcoming_meetings.html</a>
22-23 September 2010	Polaric/Cosmic Workshop 2010 Organic complementary devices & circuits.	Imperial College, London	<a href="http://www.sid.org/chapters/uki/forthcoming_meetings.html">http://www.sid.org/chapters/uki/forthcoming_meetings.html</a>
9 September 2010	De Montford University: Research and Technology Showcase	Queens Building, De Montford University, Leicester	<a href="http://www.sid.org/chapters/uki/forthcoming_meetings.html">http://www.sid.org/chapters/uki/forthcoming_meetings.html</a>
23-24 September 2010	SID-ME Fall Chapter Meeting 2010 Automotive Displays: Applications, Chances and Challenges	Mercedes-Benz Training Center Sindelfingen, Germany	Holger Meinel Daimler AG, Böblingen Germany <a href="mailto:holger.meinel@daimler.com">holger.meinel@daimler.com</a>
1-3 December 2010	17 <sup>th</sup> International display Workshops (IDW '10)	Fukuoka, Japan	<a href="http://www.idw.ne.jp/">http://www.idw.ne.jp/</a>
22-27 May 2011	International Symposium, Seminar and Exhibition	Los Angeles, California	<a href="http://www.sid.org">http://www.sid.org</a>

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SOCIETY FOR INFORMATION DISPLAY  
UK & IRELAND CHAPTER

# NEWSLETTER

Number 45

August 2010

## Chairman's Report

Myrddin Jones

Welcome to the latest SID UK & Ireland Chapter newsletter. It was a great honour and pleasure for me to be elected as your Chairman and I hope the UK and Ireland Chapter can continue to provide you with interesting events, information and networking opportunities.

2010 has already been a busy year. In January, we hosted a two-day conference at Sharp Laboratories in Oxford. Both days were 'sold out' with around 60 attendees on both days.

The first day's conference at Sharp covered the topic of 'Power saving'. Reducing power-consumption in displays is becoming increasingly important, both as we become more environmentally aware and demand longer battery lives from our ever-slimmer portable devices. The meeting covered many aspects of reducing power consumption in displays, including bi-stable effects, reflective modes, projection displays, high-efficiency backlights and the harnessing of ambient solar power. A report on the first day is given on Page 2.

The second day's conference covered 'Touch panels and overlays'. A wide range of touch technologies is available, including resistive, capacitive and optical, with options for single or multi-touch and for finger or stylus input. This meeting explained the benefits and limitations of the various touch-panel technologies, so that attendees could judge which technology might be most appropriate for their applications. Speakers from leading companies, such as 3M, gave their views on latest developments. There were also presentations on display overlays for physical protection, glare reduction, reflection reduction, privacy, heating and EMI suppression. A report on this second day will be found on Page 3.

The SID is greatly indebted to Sharp Laboratories for their great support during the two days and in particular to Dr Lesley Parry-Jones from Sharp for her hard work to make the events an outstanding success.

In April, we held a one-day conference on '3D displays' at University College in London. The event covered a broad range of technologies used to deliver 3D stereoscopic and holographic images and their

applications and human factors essential to the success of 3D. Experts from academia and industry outlined their visions, giving an insight into trends and areas of potential disruptive impact. The meeting also hosted the chapter's AGM. The conference was well attended in spite of the Icelandic ash cloud incident causing flight disruptions to

both speakers and attendees. I'd like to thank Dr Sally Day from UCL for her excellent support and arrangements – it's a pleasure to be able to host an event at such a prime location.

Looking forward, on the 20<sup>th</sup> and 21<sup>st</sup> of September the SID will host the 'Organic Electronics UK 2010 conference' at Imperial College, London. This two-day meeting will cover all aspects of organic semiconductors and their use in displays and other applications. There will be presentations from both industry and academia and include:

OLED based displays, OTFT backplanes and display electronics

OPVs and OPDs for power generation and imaging.

Semiconducting polymers, dendrimers and small molecules.

Insulator and electrode materials.

Patterning, fabrication and production methods.

We look forwards to seeing you at the conference. You will be able to book directly on the website at [http://www.sid.org/chapters/uki/forthcoming\\_meeting\\_s.html](http://www.sid.org/chapters/uki/forthcoming_meeting_s.html)



Myrddin Jones

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## POWER SAVING IN DISPLAYS

Report on the one-day meeting at Sharp Laboratories of Europe, Oxford,  
on 26 January 2010, by Lesley Parry-Jones

Reducing unnecessary power-consumption in displays is becoming increasingly important, both as we become more environmentally aware and demand longer battery lives from our ever-slimmer portable devices. This meeting covered many aspects of reducing power consumption in displays from bistable and reflective displays, to high-efficiency backlights and light sources

The meeting opened with an introduction to the host venue, Sharp Laboratories of Europe, by the meeting organizer, Lesley Parry-Jones, and was followed by a session on bistable and reflective displays.



Cliff Jones

Cliff Jones from ZBD explained how bistable reflective displays are the only viable solution for shelf-edge labels, because of their ultra-low power consumption at low refresh rates. Current ZBD displays for shelf-edge labels are powered by two button cells which last for seven years with a refresh rate below eight times per day.

Patrick Zebedee from Sharp Laboratories of Europe introduced Sharp's answer to bistable displays, their 'pixel-memory' technology which consumes power only when a pixel changes its value, and can be applied to any LC mode. Typical power consumption of a 96 x 96 monochrome pixel array with 1.3 inch diagonal at a 1Hz refresh rate is just 10µW.



Patrick Zebedee

Andrea Giraldo from Liquavista gave an overview of the company's electrowetting display technology, with particular reference to e-book applications. Although the technology does not have the power-saving advantages offered by the bistable technologies discussed above, it does offer a very promising solution for colour reflective video-rate which at least saves the back-light power consumption that is necessary in transmissive devices.



Andrea Giraldo

The first session was followed by a mini-exhibition in which examples of all three reflective displays were shown, as well as a demonstration of power-saving in Sharp Aquos TVs via the use of LED backlighting instead of the current standard CCFL technology. After lunch, the second session addressed this very issue of backlighting in TVs.

Rob Bennett from 3M explained how mandatory energy-efficiency regulations for TVs will start to come into effect in many countries during the next year or two, so that all new television sets will be sold with an energy-efficiency rating. He went on to describe how the use of optical films such as BEFs and DBEFs can improve light recycling within LCD backlights and hence improve energy efficiency.

Of course, the efficiency of an LCD backlight also depends on the efficiency of the light source used for the backlight, and Valerie Bousquet from Sharp gave an overview of the pros and cons of using LEDs in backlights. Whilst LCD TVs with LED backlights currently cost more than their CCFL counter-parts, the greater power efficiency means that the running costs are much lower.



Valerie Bousquet

After a break for tea, the final session started with the presentation of the Sharp-SID Student Award 2009 to Gary Wells from Nottingham Trent University by Mike Brownlow, a Director of SLE. Gary then presented his work on Voltage-Programmable Liquid Optical Devices. He described how the application of a periodic in-plane field to a thin liquid layer can give rise to periodic undulations in the liquid-air interface, resulting in a switchable diffraction grating.

The final presentation of the day was from Myrddin Jones from Eldico, who gave a very comprehensive comparison of the pros and cons of OLED and LCD displays, including comments on the relative power consumption of each, the conclusion being, of course, that it depends on the content being viewed, e.g. black text on a white background is more power-hungry for OLEDs than the reverse, whereas the power-consumption for LCDs is image independent.



Meeting session at SLE

## SID UK & IRELAND CHAPTER ANNUAL GENERAL MEETING 2010

University College London on 21<sup>st</sup> April 2010

The Chapter AGM took place during the course of the one-day meeting on 3D. The following officers were elected:

Director	Dr Sally Day
Vice-chair	Dr Lesley Parry-Jones
Secretary	Graham Weaver
Treasurer	Mrs Pat Crofts
Membership secretary	Mrs Pat Crofts
Meetings Registrar & Newsletter Editor	Dr John Mansell

### SHARP-SID AWARD 2009

The Sharp-SID Award 2009 was won by Dr Gary Wells

He then went on to study for a PhD at the same institution.

from Nottingham Trent University. He received his award and cheque for £500 from Mike Brownlow, a director at Sharp Laboratories of Europe, who sponsored the award. The presentation was made during the two-day meeting on Power-Saving and Touch-Panel Technology in Displays held at Sharp at Oxford in January 2010. At the meeting, Gary presented a paper on his work entitled 'Voltage Programmable Liquid Optical Devices'.

Gary completed his undergraduate studies at Nottingham Trent University in 2005.



Presentation of the Sharp-SID Student Award 2009 to Gary Wells by Mike Brownlow, a Director of Sharp Laboratories of Europe

Whilst completing his PhD, Gary worked alongside fellow physicists Professor Carl Brown, Professor Glen McHale and Dr Mike Newton, to develop a technique that creates and uses wrinkles in the surface of a microscopically thin layer of oil to re-direct beams of light. Their new 'liquid optical device' concept was reported in the prestigious scientific journal 'Nature Photonics' (July 2009). It was the painstaking research by Gary into a method for spreading microscopically thin layers of oil that led to the breakthrough that made the device possible

### SID ORGANIC ELECTRONICS UK 2010

20<sup>th</sup> - 21<sup>st</sup> September 2010, Imperial College London

This is a two-day meeting organised by the UK and Ireland Chapter of the Society for Information Display, which will cover all aspects of organic semiconductors and their use in displays and other technologies. It will involve presentations from both Industry and Academia. The meeting will cover all aspects of organic electronics including OLEDs, OTFTs, OPVs, OPDs, oxides, materials and fabrication/processing.

Call for contributed talk or poster to be submitted by 5.00pm on Monday 23 August 2010

### POLARIC/COSMIC Workshop 2010

Organic Complementary Devices and Circuits, 22<sup>nd</sup> - 23<sup>rd</sup> September 2010  
Imperial College London

This workshop for young researchers will cover all aspects of organic field effect transistors and their circuits, both unipolar and complementary.

Details of both meetings: [http://www.sid.org/chapters/uki/forthcoming\\_meetings.html](http://www.sid.org/chapters/uki/forthcoming_meetings.html)

Dr Roderick MacKenzie, Imperial, then presented a paper, **A numerical study of fullerene-derivatives – from chemical structure to thin-film mobility**. This involved molecular-dynamic simulations of how fullerenes with different side-chain lengths pack together to form solid-state films with different morphologies when processed from solution, and then how this effects charge transport in these important materials, the mobility decreasing with side-chain length.

The last paper of the morning was given by Jack Levell, University of St Andrews, on **Hybrid photodiodes making use of silicon and solution-processable organic blends for efficient UV-visible detection**. He described his work on hybrid diodes, combining simple solution processed organic thin films with inorganic photodiodes (PDs) to allow deep blue and UV light to be down converted and shifted into the detection range of Si. Devices achieved 61% quantum efficiency at 200nm. Such enhanced short-wavelength sensitivity devices are easily processed in air and will find applications in spectroscopy and imaging.

The afternoon session started with an invited presentation by Dr Jingsong Huang, Molecular Vision on **Organic photodetector on novel lab-on-chip assay platform**. He described Molecular Vision's (MV) medical point-of-care product involving an OLED which shines light through a plastic microfluidic channel into an organic photodiode (OPD) allowing bio-chemical reactants to be detected. Conventional OPDs have a responsivity and efficiency of 0.25 A/W and 6-7% compared to amorphous-Si PD's 0.3 A/W and 7-10%, respectively. Using interlayers to block electron and hole injection in MV OPDs decreases the dark current <math>10^{-6}</math> mA/cm<sup>2</sup> and the devices have now achieved identical performance (external quantum efficiency, fill-factor, open-circuit voltage, etc) as amorphous-Si devices, an impressive achievement. This was followed by Yujie Chen, University of Strathclyde contributed presentation on **Green-emission organic/inorganic composite as a random lasing medium**. In a conventional laser, light is reflected back and forth between two mirrors in a well-defined optical cavity. In these random lasers, optical feedback is achieved by light reflected from glass particles with a distribution of sizes dispersed in the lasing material, producing multiple -emission wavelengths. This work, using green-emitting PPV copolymers, has applications in displays, lighting, remote sensing, document coding and medical diagnostics. The penultimate contribution was given by Jeremy Smith, Imperial on **Morphology and charge transport in high mobility polymer-small molecule blend OFETs**. He explained that polymer materials are easy to process from solution, but have low charge-carrier mobility, while small molecules are harder to process from solution, but have a high mobility.

By blending polymers with small molecules you can combine the advantages of both systems. Using slowly dried films to optimise crystal-grain size, a mobility of 3 cm<sup>2</sup>/Vs was achieved in top-gate OTFTs.

The Plenary Address was the last paper of the day and was presented by Professor Henning Sirringhaus FRS from the University of Cambridge and Plastic Logic, on the **Physics and applications of polymer field-effect transistors**. The paper was originally scheduled for the opening of the first day, but was changed owing to an unexpected commitment. Professor Sirringhaus first stated that solution processed OFETs have now achieved a mobility of 1 cm<sup>2</sup>/Vs, the same as conventional amorphous-Si TFTs used in large-area AMLCDs. Plastic Logic's Dresden plant, opened on 17 September 2008, will now fabricate 100,000 units per year of their electrophoretic-OTFT based eReader. He then discussed further improving OTFT performance. Using self-aligned printing, via de-wetting, in which no photolithographic step is required, he can shrink the channel length to 200 – 400 nm. Using a photosensitive dielectric and then an ink-jet printed metal ink, it was possible to self-align the gate. With a high mobility thienothiophene polymer pBTTT (0.1 cm<sup>2</sup>/Vs), a drive frequency of 1.6 MHz was achieved. Having achieved a 75 TFT array with 100% yield, Plastic Logic is now scaling up to > 200 OTFT array in a joint project with DuPont Teijin and Merck. He then discussed the reliability of TFTs. Using high-resolution techniques, such as scanning Kelvin probe microscopy, he has measured charge trapping in the grain boundaries between crystals in the high mobility thienothiophene polymer and believes these are related to water or oxygen.



The Merck Prize for the Best Student Poster being presented to Sungsoo Kim by Dr Toby Cull of Merck

Finally, the prize for the Best Student Poster was presented to Sungsoo Kim. The meeting was then closed by the conference chair

This one-day conference focused on touch panels and overlays. It was a very well attended event with around 60 attendees. Space was provided for product demonstrations during the breaks and most presenters brought product examples along to demonstrate their talks.

The first session was an overview of the touch-panel market by Myrddin Jones. The market has flourished in recent years with around 170 touch panel manufacturers in mass production world-wide. Touch screen revenues are forecast to increase from \$3.7B in 2009 to \$9.1B by 2015, - much faster growth than the display industry overall. Resistive touch panels dominate (80% by volume, 43% by value) followed by projected capacitive (17% by volume, 25% by value). The hot topic in the industry is multi-touch capability, which is forecast to reach \$4.2 billion by 2015, 47% of total touch module revenues.

Paolo Pedrazzoli from 3M introduced the company's projected capacitive touch technology. This multi-touch technology has the potential to shift from single user interfaces to collaboration interfaces and do multiple tasks simultaneously providing a more immersive user experience.

Gregg Brown from Zytronic, a manufacturer of touch panels, controllers and software based in the UK presented their projected capacitive technology using fine embedded wiring. Zytronic's unique patented technology uses a sensor which can be completely embedded behind glass.

Chris Brown from Sharp Laboratories Europe described the challenges of creating an integrated (in cell) optical touch panel. An optical touch panel provides a platform for a new mobile user interface with low-cost multi-touch with finger or pen input. Extra functions such as contact scanning can be incorporated and the infra-red sensing eliminates any display-image dependency. One of the remaining challenges is robustness to severe environmental conditions which is being addressed by in-pixel temperature compensation to reduce dependency.

Nic Lawrence from Light Blue Optics talked about 'Light Touch' – a system for transforming any flat surface into a touch screen. Light Touch projects a full-colour image onto any flat surface. An infra-red laser and lens creates a sheet of IR light just above the projected image. When a user touches the image it breaks the beam and the reflections are seen by a CMOS camera, processed by

hardware IC and reported. The system is calibrated and so can report touch events across the whole image. There are many different applications for Light Touch, across markets as broad as consumer electronics, retail, and hospitality, industrial, medical and digital signage.

Rob Bennett from 3M introduced display performance characteristics that can be altered by additional coatings or overlays including enhancements to contrast and readability, durability and privacy. Their focus materials include anti-glare surfaces, anti-reflective surfaces, circular polarisers, louver films and air-gap elimination.



Rob Bennett

David Payne and Neil Palmer from Optical Filters Ltd. a UK company focusing on the design and manufacture of optical filters to enhance flat-panel and touch-screen displays talked about their EMI shielding, ruggedisation and image-enhancement materials. Their 'EmiClare' technology is claimed to be the only woven mesh designed for electronic displays with higher light transmission, minimal image distortion & Moiré fringing and uncompromised shielding effectiveness.

Finally, Neville Worthington of Weatherall Equipment Ltd. introduced the Nitto Jushi 'Clarex' range of technologies including hard coating, anti-glare filter, anti-reflection coating, anti-bacterial coating and UV protection.

This final contribution brought the two-day meeting to a close. The SID committee would like to thank Sharp Laboratories of Europe, Oxford for

their excellent support and arrangements to make this a successful day.



Myrddin Jones



Lunch-time discussion at SLE

## UK & Ireland Chapter Meetings

Details of Chapter meetings can be found at:

[http://www.sid.org/chapters/uki/forthcoming\\_entry.html](http://www.sid.org/chapters/uki/forthcoming_entry.html)

On-line registration and payment for meetings have recently been introduced. Click on the registration link for the appropriate meeting, fill in you details and click on the 'Submit' button. Then click on the payment link, which will take you to the chapter PayPal account. Click on the appropriate 'Pay now' button and follow the instructions. A receipt will be sent by email. We are phasing out payment by credit or debit card at meetings, because the facility has become too expensive

## SID ORGANIC ELECTRONICS UK 2009

Report on the two-day meeting at Imperial College, London on 28-29 September 2009 by Alasdair Campbell and John Mansell

**SID Organic Electronics UK 2008**, organised by the UK & Ireland Chapter of the SID, was held at Imperial College London on 28<sup>th</sup> and 29<sup>th</sup> of September, 2009. It was the third Organic Electronics meeting held at Imperial and covered all aspects of the area including organic light-emitting diodes (OLEDs) and thin-film transistors (OTFTs), polymers, small molecules and fullerenes, dielectrics and conductors, display electronics, oxides and hybrid devices, organic photovoltaics (OPVs) for power generation, device and circuit modelling and printing and fabrication methods.

The meeting was opened by Dr Alasdair Campbell who welcomed the speakers and delegates. The first invited presentation was on **Phosphorescent OLEDs enabling white lighting** by Dr Mike Weaver of Universal Display Corporation. He pointed out that 20% of the consumption of electricity was used for lighting and there was an urgent need to get away from the current inefficient methods of generation. A lifetime of >25,000 hours indoors and >35,000 outdoors and a luminaire efficacy of 70 lumens/Watt were needed. White phosphorescent OLEDs were showing great promise with lifetimes of 25,000 hours, luminousities of 1,000-3,000 cd/m<sup>2</sup> and efficiencies of 80 lumens/W. Additionally, UDC's large area white lighting had reached 68 lumens/W.

The second invited presentation was given by Dr David Kronholm, Solenne BV on **Advances in cost-effective fullerene-derivative organic n-type semiconductors**. He reported that Solenne was developing a range of new n-type fullerenes for large-area OPVs and OTFTs with particular emphasis on cost reduction. Performances have improved (PCBM OTFTs have reached 0.2 cm<sup>2</sup>/Vs), and Solenne are trying to tailor the fullerene electron affinity to fit the p-type polymer in blend based OPVs whilst maintaining or improving processability. By avoiding unnecessary purification steps, the cost of these important materials could be dramatically reduced with minimal impact on device performance.

The subject of the next invited talk was **Low-voltage organic transistors for flexible active-matrix displays**, presented by Professor Hagen Klauk of the Max-Planck-Institute at Stuttgart. The majority of current active-matrix LCDs use amorphous silicon because it has an acceptable mobility, but there are two disadvantages: they are very inefficient since a lot of the light is absorbed, and the substrates are not flexible. Pentacene OTFTs are processed at low temperatures and can, therefore, be made on flexible substrates. Highly uniform bottom-gate/top-contact OTFTs have been fabricated, and air-stable, self-assembled



David Kronholm

monolayer dielectrics of thickness 2.1 nm have been used to reduce the drive voltage. In order to get a fast enough response for modern displays, an inkjet-printing method has additionally been developed with very small droplet volumes to print very fine features, reducing the OTFT channel length from 20 to 2 microns. Professor James Durant of Imperial College London then gave an invited talk describing **Charge density measurements in polymer/fullerene solar cells**. He described how the value of the electron mobility depends on how it is measured, and may change across a device depending upon the photogenerated charge density. The basis of the measurement technique consists of illuminating the OPV test cell, switching off the light and then measuring the discharge current. An understanding of these variations in mobility is very important in the modelling of device behaviour.

After the lunch break, the afternoon session started with an invited talk given by Professor Donal Bradley, FRS of Imperial College London on **Printing and patterning for light-emitting structures**. He started by listing the five UK National Centres working in the area of Plastic Electronics. He then discussed patterning methods such as interlayer lithography, gravure printing, spray coating and stamp transfer printing, followed by the problems of trying to make sub-wavelength polymer optical structures for telecommunication applications. Simple structures have been made using masked solvent vapour exposure to provide patterning. It is possible to make layers having areas where there is a change in refractive index of 1.4%. This is large enough to enable optical guides to be realised. Planar structures with a graded-index profile have been fabricated, and the process does not damage the luminance gain.

Johannes Herrnsdorf, University of Strathclyde then spoke on **Optical gain from light-emitting nanocomposite membranes**. He discussed the development of organic light-emitting materials for lasers with star-shaped oligofluorene truxenes and a poly(phenylene vinylene) (PPV) copolymer as active fluorophores. By embedding these materials in a photo-curable polymer matrix, optical gain could be achieved in free-standing films.

Dr Marc Sims of DuPont Displays then gave an invited talk on **Optically-detected charge density dynamics in organic light-emitting diodes (OLEDs)**. Using a double lock-in amplifier electromodulation technique, he could measure the absence of the electric field in the hole transport layer of an OLED, as well as the charge carrier density at the internal interface. He then showed how



Johannes Herrnsdorf

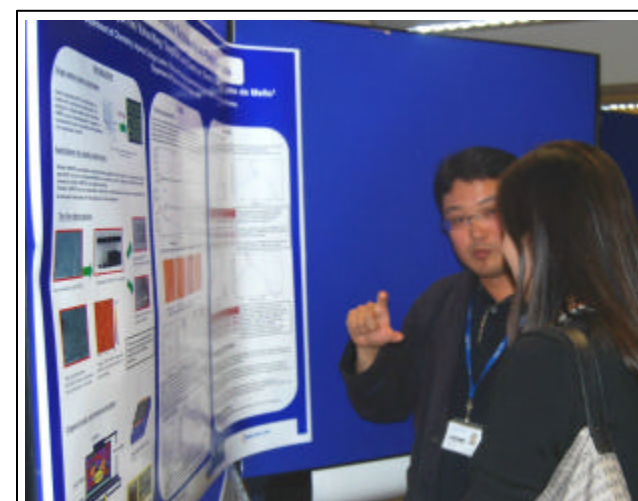
DuPont's new hole-injection layer gave much better injection, much better overall performance and a much longer device lifetime than conventional PEDOT:PSS.

John Labram of Imperial College London then gave a presentation on **Light-sensor circuits based on organic phototransistors**. Bulk heterojunction and bilayer polymer-fullerene phototransistors can be fabricated easily in large-area arrays, and showed low-voltage operation, greater than 20 ms response time and a linear output voltage response with optical power. The final invited contribution of the day was given by Dr Toby Cull of Merck Chemicals on **Process-resistant dielectrics for high-performance OTFT's**.



Toby Cull

Merck have developed printable (flexo, gravure, inkjet) formulations based on multiple-solvent components for both dielectrics and amorphous and crystalline OSCs. These have been optimised to produce high performance bottom and top gate OTFTs, the best material reaching a mobility of 4 cm<sup>2</sup>/Vs, similar to amorphous silicon. The first day then closed with a drinks reception and the poster session. Over 15 posters were presented by authors from a number of Universities including Imperial, Sheffield, Warwick, St Andrews, Oxford, Surrey, QMUL and UCL (UK) and Ajou (Korea), Queensland (Australia), Boston (USA), ETH Zurich (Switzerland), Eindhoven (The Netherlands) and laboratories in the UK, Germany, Italy and The Netherlands. Topics covered all aspects of organic electronics. The winner of the Merck Prize for the Best Poster was Sungsoo Kim with a poster entitled **Single-walled carbon nanotube electrodes for organic solar cells**.



Sungsoo Kim in discussion at his stand during the poster session

The second day opened with an invited talk by Professor

Guglielmo Lanzani, Politecnico de Milano on **Molecular photonics: new concepts and devices**. He first discussed developing new organic device systems to replicate the response of the human eye, polymer blend and polymer-fullerene films showing no change spectroscopically in aqueous and saline buffer solutions, which mimic the internal body environment.

He then described new pump-push-probe experiments of a short cylindrical molecule threaded on a polymer chain, switching in polymer optical fibres, femtosecond laser irradiation and chemical etching, and optofluidic random lasing with titanium dioxide nanoparticles.

This was followed by an invited presentation by Dr Ashley Cadby, University of Sheffield on **Understanding the importance of morphology in photovoltaic applicable blends of conjugated polymers**. Polymer blends for OLEDs were investigated using sub-micron imaging techniques such as time-correlated single-photon counting near-field optical microscopy, and showed phase separation at different length scales when deposited from different solvents. Other measurements on OPV blends showed charge trapping and localisation, indicating that charge extraction is still a major limiting factor in OPV efficiency. David Mohamad, University of Sheffield then discussed **Conjugated double cables for organic photovoltaics**, which are polymers with a conjugated backbone and different, decoupled conjugated sidechains, the system mimicking the functionality of the two-component blends used in conventional OPVs but allowing morphology to be carefully controlled.



Ashley Cadby

Professor Peter Skabara, University of Strathclyde, was next on the programme with an invited talk on **Properties and applications of star-shaped oligofluorenes in organic electronics**. He discussed the synthesis of star-shaped single molecules consisting of three fluorene oligomer arms on a phenyl core for OLEDs and photonics. They are easily purified, have excellent solubility, form amorphous films, are very stable in ambient, and are blue emitters. The arms are prepared individually and the material can be made in large quantities. Good yields have been obtained and they are improving as the conditions are optimised. They can be embedded in photo-patternable, crosslinkable polymer matrices, can be ink-jet printed, and ASE has been achieved in films of some derivatives. Other variants on these star-shaped molecules have been prepared with different conjugated units to control charge transport and light-emission wavelength.

Report continued on Page 6