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SID has announced a new Senior Member Grade, which is for individuals who have made significant technical contributions to the advancement of displays and who have demonstrated active participation in the display community and in SID. The requirements for the Senior Member Grade are:

A candidate must have been a member of SID in good standing for at least 3 years of continuous membership immediately prior to the submission of an application.

A candidate must have been an SID member for at least 5 years.

A candidate must have demonstrated 'significant performance' over a period of at least five years in the field of information display. 'Significant performance' means substantial job responsibilities such as a program or project leader, engineer or scientist with some proven measure of success, or faculty member developing and teaching courses that include research and publication.

A candidate must have been a 'practising professional' for at least seven years in the field of information display. A candidate must satisfy at least one of the following conditions:

- Published or presented (authored or co-authored) at least 5 papers in the Journal of the SID, in Information Display, at SID-sponsored conferences, or at SID-sponsored regional conferences or workshops. Local Chapter conferences are excluded. or
- Served on the Executive or Organising Committee of at least 2 SID-sponsored conferences, regional conferences, or workshops. Or
- Served as an SID Chapter or International Officer for at least five years. Full information on how to apply can be found on the SID web site www.sid.org.

Fellows and Life Members of SID are not eligible for the Senior Member Grade.

FORTHCOMING MEETINGS

Date	Title	Venue	Contact
14 July 2004	**Defence & Dual-use Displays** One-day meeting	QinetiQ, Malvern	www.sid.org.uk
28 September 2004	**Medical Displays** One-day meeting	NPL, Teddington	www.sid.org.uk
19-22 September 2005	**IRDC/Eurodisplay 2005 Conference & International Exhibition**	**Edinburgh International Conference Centre**	**jrsid@nildram.co.uk**
29-30 June 2004	**NPL Optical Radiation** Measurement Club AGM	NPL, Teddington	www.npl.co.uk/optical_radiation/ormclub/meetings

CONTACT INFORMATION

Name & address	Tel/fax	email
Director: Dr Alan Mosley 6 Chilton Park Avenue, BERKHAMSTED, HP4 1EU	0781 270 2424	alan@amosley.freeserve.co.uk
Chairman: Dr Ian Sage,	01684 895026	sid.uk@tiscali.co.uk

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Number 38 **NEW**

A WORD

I was reading recently about the latest ge flat panel TV displays, which improve th speed of the liquid crystal by overdriving it according to the brightness of each pixel in both before and after the addressing cycle. the technique is highly effective and no do represent one more step toward the acceptance of LC TV in the home. I gue viewing public will be pretty much unaware of the cleverness going on here – they will just like the picture. Indeed, I detect a trend at retail outlets recently that even terms like "LCD" or "plasma" are disappearing from consumer displays. That is, no doubt, just as it should be. Ideally, the display vanishes from sight, and we only see the information on it. Reading this, though, brought home to me the apparent paradox in display development at present, that although much of the excitement in the field surrounds the new and upcoming technologies like electroluminescence and electrophoretic de still LCDs and CRTs which most of us h homes and workplaces. Maybe it is a refl more general attitude that we are more "switc leaps of new science than by the steady i improvement of an established display.

DEVELOPMENT OF OLED SYSTEMS

One-day meeting at the National Physical Laboratory, 27 November 2003

Report by Colin Campbell

This SID meeting on Development of OLED systems covered a wide range of OLED related topics with the latest news on OLED markets, systems, chemistry and physics being presented by various industrial and academic experts.

The first paper of the morning, **OLEDs, Critical Issues and Critical Mass**, was presented by Andrew Murray of iSuppli/Stanford Resources and the main points were:

- Recent CDT developments were reported – moving beyond a pure IP model company, ending production in Godmanchester, reducing number of employees, looking for Asian partnerships. Now connected with Ulvac and Litrex - inkjet printing interests, could possibly expand into inkjet printing of spacers for LCDs.
- Toppoly have decided to use a-Si (amorphous Silicon) for AMOLED (Active Matrix OLED) displays as LTPS (Low Temperature Poly Silicon) is not mature enough.
- Mobile phones are predicted as the largest OLED application. Fujitsu are already using Pioneer OLED display in mobile phones.
- There has been a massive increase in test equipment manufacturers developing OLED related products – Toyo, Integral Vision, Photal, Shimadzu, EHC.
- Prediction that in 2006 many low value inkjet printed AMOLEDs will be integrated into white goods.
- Current challenges for OLED – more transistors per pixel, threshold voltage has high stability tolerances, LTPS partners needed, suitability of a-Si, competition from AMLCD with increasing performance, falling prices and is top emission necessary?
- The future challenges for OLED – flexible displays, flexible encapsulation, driving difficulties for current driven OLED using organic electronics. A
- Emission due to singlets IS > 25% otherwise efficiencies could not be as high.
- A QVGA 3.5” AMOLED with 125*50 µm inkjet printed pixels was announced.
- CDT’s current best material electron mobility, ageing and uniformity were reported as:

  A-Si: 1 cm^2/V_s, poor ageing, uniformity and V_t (threshold voltage) degrade with age. 300 µm channel width needed for 300 µm pixel pitch with mobility of 8 cm^2/V_s.

  LTPS: 80 – 160 cm^2/V_s, good ageing but poor uniformity. 11 µm channel width needed for 300µm pixel pitch with mobility of 100 cm^2/V_s.

  CGS: (Continuous Grain Silicon): 300 cm^2/V_s, good ageing and uniformity, also good for electronics: chip-on-glass.

  Crystalline Silicon: 500 – 1000 cm2/Vs, ageing OK, uniformity is process dependent, must be top emitting.

In the opinion of CDT:

- Displays over 100*80 should be use active matrix, not passive.
- Bottom-Emission - compromises aperture due to electronics between OLED and glass.
- Top-Emission - full pixel area can be used for emission but encapsulation is a problem.
- Photodiodes on each pixel can feedback pixel performance and boost lifetime.
- During questions, Euan was asked why the photodiode did not react to ambient. He replied that the photodiode level is read before the OLED is lit and then used as an offset.

The session continued with a paper by Dr Andrew Steer of Philips Research Laboratories on, **System Aspects of**

In addition, the ability for all layers of
transistor to be formed from solutions mean
is no need to use photolithography and the
photomasks. The materials can be patte
inkjet printing and/or laser writing. A typi
transistor fabricated by Plastic Logic has the
characteristics:

- Channel Width 300 µm
- Channel Length 5 µm
- On/Off Ratio >106

In order to obtain the very short channel
channel area is delineated by a hydrophol
region bounded by a hydrophilic surface regi
which have been defined by laser writing.

Applications presently being targeted by Pl
are active matrix backplanes for bistab
technologies being developed for electroni
companies such as, E-ink, Six-Pix and Gyric
Logic intends to exploit its technology by lic
display manufacturers.

The final presentation of the meeting was g
Ian Underwood of MicroEmissive Displays L
(i.underwood@microemissive.com), who
MED's development of a polymer OLED
microdisplay technology. Dr Underwood
presentation with an outline of the potential r
emissive microdisplays. An existing market
large and growing is that of electronic view
digital still and video cameras. These m
already served by LCDs, but their simple
operation (no separate light source requi
polymer OLED microdisplays an opto-
advantage. MED’s use of a CMOS act
backplane also confers a significant potential
in terms of simplifying the electronic inter
display. Proposed future markets all related t
displays. These could be simple head mount
for computer games, DVD players and/
phones.

MED currently uses a white polymer OL
with colour filters (provided from the Fa
produce a 320 x RGB X 240 display, which h

AGM Meeting report continued

The next presentation was given by the author (alan.mosley@theifmcompany.com) and described The IFM Company's design for a novel display that is readily readable under all ambient lighting conditions.

The main application is for public information displays for railway stations, bus services and sports stadia. The key feature of the IFM display is the use of a transflective LCD in conjunction with a pixellated backlight. In order to provide a bright image in reflection, the LCD is based on the use of dichroic dyes rather than polarisers: this provides a display with reflectivity of ~35% compared with <10% for a polariser-based LCD. Another feature of the current IFM technology is the use of plastic substrates for both the transflective LCD and the pixellated backlight. To achieve this, the LCD is based on the dyed nematic curvilinear aligned phase (NCAP) effect and the backlight uses thick film EL technology. To meet applications that demand very long lifetimes and where the pixellated backlight will be in operation a large proportion of the time, a pixellated LED backlight is being developed. The changeable weather over the two days of this event enabled the author to demonstrate that the IFM display was effective in both very bright sunlight and the dim ambient light of the demonstration area.

A presentation on the use of optical design software to provide highly optimised lightguides for use in backlights for LCDs and advertisement posters was given by Mike Hanney of Polymer Optics (mike.hanney@polyopt.freeserve.co.uk). The design process begins with a definition and consideration of the following:

- Mechanical specification
- Light Source specification, e.g. how many LEDs and total power consumption
- LCD/Poster specification, e.g. size shape, %transmission
- Illumination Expectations, e.g. colour co-ordinates, luminance, uniformity
- Characteristics of the Application, e.g. viewing angle required, ambient-light range

The final afternoon session was started by Chris Williams of Logystyx Ltd (chris@logystyx.co.uk), who described a new DTI initiative called FLEXYNET. More information on FLEXYNET can been found in the enclosed leaflet.

The range of materials that have been developed by ELAM-T for organic light emitting diode (OLED) displays was described by Professor P Kathirgamanathan, the Technical Director of ELAM-T (earthkingdom1@hotmail.com). ELAM-T has developed both emitters and charge carriers for OLED displays, which are covered by 58 patent applications. The emitters are based on fluorescent and phosphorescent emitters, including compounds containing rare-earth metals such as terbium and europium. It has been found that one material, designated E246, can be used as an electron transport layer and that it provides a non-toxic alternative to the aluminium quinolate (ALQ) presently used in many OLED devices, which it was stated is highly toxic. It was reported that ELAM-T has developed red, green and blue emitters, including a blue emitter that has an efficiency of 12 cd/A. Professor Kathir showed a plot of lifetime versus luminance required for different products. The least demanding were hand-held products, e.g. mobile phones and PDAs, while the most demanding was consumer television. ELAM-T, which also develops and fabricates OLED devices in order to evaluate its own materials, plans to exploit its work through licensing agreements with suppliers of OLED materials.

Dr John Mills (john.mills@plasticlogic.com) of Plastic Logic described his company's development of organic electronics, which he proposed was a Disruptive Technology. Plastic Logic is currently targeting flexible active matrix backplanes for e-paper applications. But according to Dr Mills, there will also be many other applications that are not apparent at the moment, because this is the nature of Disruptive Technologies.

He cited, as an example, the laser, which when invented in the 1960s had no obvious application, but today the majority of households in the West each contain at least 2 -3 lasers.

The advantages of organic electronics were said to be:

- Low capital investment

- To fix differential ageing, a phot phototransistor can be employed in eac deliver feedback to the driving elect current, the storage capacitor will be dep than without feedback.
- The first attempt was sensitive to ambie poor spectral response uniformity.
- An NIP photodiode hidden behind the solved the problem.
- During the discussion following the pr Andrew stated that the largest display Philips was small for research purposes. to a question on the practicability of disp 20-30" range, he mentioned that IBM had displays, but the yield was poor. He thou the time that blue lifetime had been imp size would have been increased as well.

The last paper of the morning was on **Ligh Dendrimers**, by Professor Ifor Samuel of the of St Andrews

- Dendrimers offer solution processabl whose electronic and processing propert independently fine tuned.
- Dendrimer structure was summarised as f
  - Core: Light Emission
  - Dendrimer Branches: Electronic Prope
  - Surface Groups: Processability.
- Primary colours can be created by using structured molecules. Blends of structured molecules can produce other c
- Green Q.E. (Quantum Efficiency) 16%, 5.4%.

When asked how the efficiency of the red dendrimer compared with that of the red small molecule, Ifor answered that the red dendrimer was slightly higher, but small molecule efficiencies will have advanced. In answer to

Novel and Emerging Technologies for Displays

AGM and two-day meeting at Knebworth Park, 31 March and 1 April 2004

Alan Mosley, Director of UK & Ireland Chapter

This year's two-day technical meeting, coinciding with the Centre AGM, was mainly devoted to the latest improvements in the wide range of display-related technologies being developed by Small to Medium Enterprises (SMEs) in the UK. The three exceptions to this generality were presentations from Sharp Laboratories Europe, which is not an SMEs, and Nemoptic and Ntera, which are French and Irish SMEs respectively. Many presenters showed demonstrators, which not only provided excellent examples of their technology, but also enabled the performance of similar technologies to be readily compared.

Day 1 - Wednesday, 31 March

The meeting on the first day began with a presentation by Dr Adrian Travis of Cambridge Flat Projection Display Ltd (arlt1@eng.cam.ac.uk) on his development of a plastic wedge-shaped transparent projection screen. The principle of operation is that each line of the image from the projection lens will enter the wedge-shaped plastic at a slightly different angle and will therefore cease to be totally internally reflected at a slightly different point. This results in the complete image being reproduced on the wedge-shaped screen. Dr Travis pointed out that projection offered an effective method of providing a large screen image, but that the current techniques of front and rear projection were unsatisfactory. In normal ambient lighting front project had poor contrast and while rear projection offered better contrast it was at the expense of a bulky system. Dr Travis claimed these problems would be overcome by the use of the wedge, which when fully developed should provide a high contrast image in a compact system. A contrast ration of 100:1 and a screen luminance of 500 cd/m2 were predicted. The demonstrator shown by Dr Travis had a 14- inch screen. The image was not perfect, but was a substantial improvement on the image seen by the

Adrian Travis

adopted and improved upon the Philips hop-plate technology. The hop-plate, which is placed over the cathode plane, has one conical hole per pixel coated with a secondary electron emitter and an electrode at the exit end. The hop-plate has unity gain and not only improves pixel to pixel uniformity, but also collimates the electron beam and thereby eliminates crosstalk between adjacent pixels. Dr Tuck predicted that the price of a 42-inch display based on PFE's technology would cost $470 ex works in 2010.

Cécile Joubert of Nemoptic, France (c.joubert@NEMOPTIC.com) summarised the development of the BiNem™ technology for producing bistable LCDs in which the image is maintained without power for several days. The key to the BiNem™ technology is the use of a weak anchoring surface alignment, which enables the liquid-crystal layer to assume two stable states, namely twisted and planar. The optical properties of these two states are different so that between crossed polarisers the twisted state is black and the planar state is white. To switch between these two states it is necessary to adjust the shape of the addressing pulse. The key features of the BiNem™ technology are:

- Contrast ratio in transmissive mode; 100:1
- Contrast ratio in reflective mode, optimised for brightness; 12:1
- Response time; 1-2 ms per line
- Operating temperature range; 0 to +50^{0}C
- 16 grey levels in a VGA display
- Cell spacing; 1.5 to 2.0 µm

Nemoptic intend to exploit their technology by licensing its use in applications such as the electronic book. A version of the BiNem™ technology on plastic substrates is being developed for use in Smart Cards.

A presentation on a competing bistable LCD technology was then given by Dr Cliff Jones of ZBD Displays (jcjones@zbddisplays.com). The ZBD technology

compare the BiNem™ and ZBD technologi side, both companies had provided approxi size VGA displays. From this comparis concluded that the ZBD technology pro brighter display, an important advantage for display.

Dr David Corr of Ntera, (david.corr@ described his company's approach to elec displays. The key advantage of the Ntera tec the use of a layer of titanium dioxide fo nanoparticles, which provides a very large s In their coloured state the electrochromic molecules are bound to this nanoparticulate because of the latter's large surface area prod dark state. In their non-coloured electrochromic material appears colourles viewer sees the intensely white titanium dic Dr Corr reported that the contrast ratio of display in reflection was 20:1 compared w obtained from printed paper. Ntera intend their technology through licensing and are discussing its manufacture with companies East. Two applications mentioned by Dr Customer Information Systems, i.e. public boards and low information content, i.e. pixels, 6-inch diagonal, plastic displays for book applications. Because it is not p multiplex electrochromic displays, the latt driven by an array of thin film transistors (TF

The final presentation of the first day was g Harry Walton of Sharp Laboratories Eur (harry.walton@sharp.co.uk). Dr Wa described the development of electronic di devices based on Continuous Grain Silicon (C thin film semiconductor, which is depos catalysed solid phase crystallisation process, has a mobility of 300 - 400 cm^2/Vs: this is much higher than the mobilities of the other thin semiconductors, amorphous