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SOCIETY FOR INFORMATION DISPLAY

SID-ME Chapter Fall 2006 Meeting

“New materials for OLEDs and LCDs and new driving technologies”

**Fraunhofer Institute for Applied Polymer Research,
Potsdam, October 9-10, 2006**

The Fraunhofer Institute for Applied Polymer (IAP) Research at the science park Golm in Potsdam organized the SID-ME Chapter Fall 2006 meeting on “New materials for OLEDs and LCDs and new driving technologies”. The science park Golm comprises a cluster of several Max Planck Institutes, the Fraunhofer institute and the mathematical and physics departments of the University of Potsdam. In his introduction Hans-Peter Fink, the IAP director, explained the mission of the Fraunhofer community, which can be summarized as “furthering the trajectory from research to applications”. In the case of the IAP the research topics relate to functional polymers, including basics, processing and flexible substrates. The IAP involves about 160 employees and has a budget of 10 Million Euro. There are five research divisions: natural polymers, functional polymer systems, synthesis and polymer technology, water-born polymer systems, and a pilot plant center Schkopau.

Armin Wedel, head of the functional polymer systems division,

organized the meeting. The conference comprised 16 oral presentations, a tour of selected groups from the institute and a conference dinner in the micro-brewery “Alte Meierei”. There were 43 attendants.

Session 1, October 9, afternoon New materials for OLEDs

Dieter Neher (University of Potsdam, Germany) talked about “efficient electrophosphorescence with polymer-based multi-layer structures”. Polymer system efficiency approaches that of small molecules and an external quantum efficiency of 19% is reported for a three layer structure.

Hartmut Krueger (Fraunhofer IAP, Potsdam, Germany) discussed “Phosphorescent-emitting systems attached to a non-conjugated polymer backbone for application in light emitting devices”. High efficient and high brightness Ph-OLEDs have

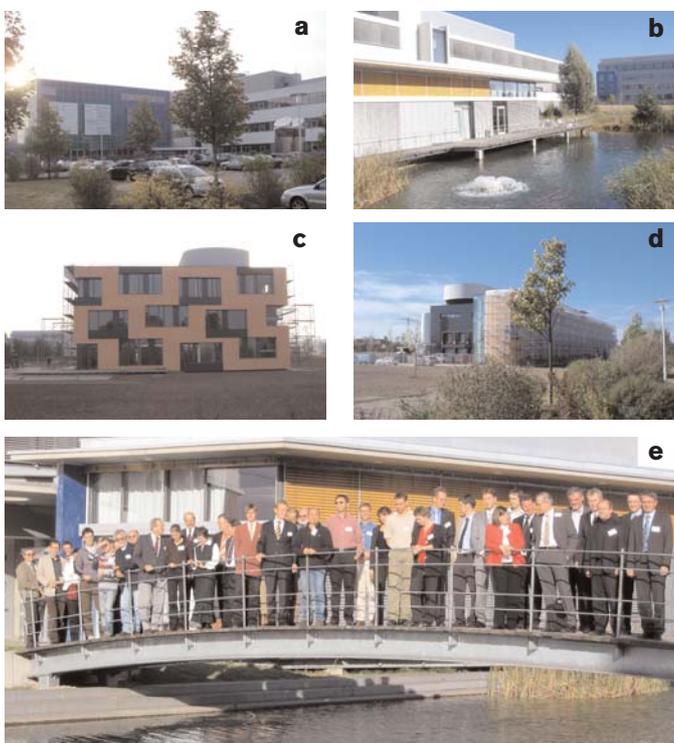
been realized for a system with hole transport-, electron transport- and triplet emitter -groups attached to a polystyrene backbone. Short spacer length is preferred for a high efficiency.

Anne Koehnen (University of Cologne, Germany) explained “Fabrication of high resolution passive matrix displays by direct lithography”. The emissive layer is also a photoresist allowing patterning of RGB structures down to a few micrometer size.

Paul Burn (University of Oxford, United Kingdom) gave a talk entitled “Dendrimer: well defined materials for OLEDs”. Dendrimers were shown to provide an interesting architecture for embedding emissive material. Efficient and long life solution processed OLEDs have been made.

Volker Lischewski (Sensient Imaging Technologies, Wolfen, Germany) presented “Advances in high Tg hole transporters”. Although the glass transition temperature Tg is linked to structural changes, there is no unique correlation between Tg and device lifetime. A new high Tg hole transport material, Li228, that can widen the operational temperature window was reported.

Sven Ammermann (University of Braunschweig, Germany) discussed “Color tuning of triplet emitters for OLED applications”. The goal is to make a white-OLED, for general lighting or car applications, using a polymer backbone with attached blue- and yellow-triplet emitters. The tuning results with chromophoric and saturating ligands were shown.



Pictures of Fraunhofer institutes at the science park Golm: a) and b) front and back side of the Institute for Applied Polymer research, c) and d) front and back side of the new next door Institute for Biomedical Technology starting work in 2006, e) group photo.

Session 2, October 9, afternoon New materials for OLEDs/LCDs

Joerg Posdorfer (Ormecon GmbH, Ammersbek, Germany) introduced the “Characterization of OLEDs during operation by impedance spectroscopy”. Via equivalent circuit analysis interesting properties of the component layers such as dielectric thickness, conductivity, carrier depletion, carrier unbalance and relaxation times can be obtained. This knowledge can then be used for device optimisation.

Uwe Vogel (Fraunhofer IPMS, Dresden, Germany) talked about “OLED-on-CMOS for micro-display applications”, for instance for bi-directional near to eye displays for medical surgery. The performance of nip and pin configurations with Al and TiN electrodes was evaluated. Integration of RGB OLED stacks on CMOS was successfully tested. The integration of photodetectors is on-going.

Jochen Brill (BASF AG, Ludwigshafen, Germany) reviewed the company's research on “Polymerisable liquid crystals for optical films”. It was shown that reflective polarizer and retardation films are feasible using polymerisable liquid crystals as base material. The coating technology can be applied in continuous and batch processes allowing for large film width.

Conference dinner

The SID-MEC conference dinner event took place in the restaurant of a micro-brewery “Alte Meierei” situated beautifully on the banks of the Spree river. Before dinner the brewing process was explained, ending with a tasteful product check. Indeed, the preparation of high quality products with tuned desired properties starting from basic components, was a main theme of this fall meeting. The very good buffet style dinner enabled a lively mix of people and discussion topics; see impression below.



Impression of the visit to the micro-brewery “Alte Meierei”

Session 3 October 10, morning New materials for LCD's

Nathalie Dessaud (Philips Research, Eindhoven, The Netherlands) discussed "Reverse flow in multidomain VA-LCDs: the effect of material parameters and drive scheme". Using ID modelling and test cell measurements trends are derived on how material parameters and driving techniques such as over-drive and pre-drive affect the material flow.

Daniel Krueke (Fourth Dimension Displays Ltd, Dunfermline, CA-USA) talked about "New materials for ferroelectric microdisplays used for phase modulation and amplitude modulation. FLC properties, such as fast and in-plane switching, can provide an excellent match for both amplitude or phase modulation type microprojectors. Using diffractive optics and laser illumination new pocket size digital video projectors have been build. Taking away FLC's fragility, a remaining topic that scientists work on, would immediately boost industrial interest.

Michael Wittek (Merck AG, Darmstadt, Germany) gave a presentation on "Fast switching LC materials for TV application". The relations between material parameters and switch performance were explained and explored for adapted materials. For both IPS and VA technologies new materials that enable reduced switching times were identified.

Joachim Stumpe (Fraunhofer IAP, Potsdam, Germany) discussed "New concepts for anisotropic films in LCDs". In a supramolecular concept the functional groups are attached to polymer backbone overcoming the use of functional polymers. This offers a high degree of flexibility. A one layer approach, where alignment is induced by light or self organisation can be achieved. The materials combine a high stability and high optical anisotropy (50:1).

Session 4, October 10, morning New driving technologies

Peter Koenig (Fraunhofer IPMS, Dresden, Germany) presented a "Platform for investigations of PMOLED driving and characterization". Hardware, interface, firmware and software has been developed to assess PMOLED aging. Outputs are a.o. the forward voltage distribution and automatic display parameter extraction.

Chihao Xu (University of Saarland, Saarbrücken, Germany) discussed the "Dependence of OLED display degradation on driving conditions". The PMOLED luminance degradation was studied as a function of pulse height and duty cycle. The results indicate that multiple line addressing is most promising to improve PMOLED lifetime.

Norbert Fruehauf (University of Stuttgart, Germany) presented the final talk on "Flexible display technologies". The talk highlighted properties and process development for transparent electrodes made with PEDOT or CNT suspensions, and TFTs made using pentacene and CNT semiconductor materials.

TFTs with high on/off ratio have been obtained. These examples also served to show that flexible displays encompass more than conventional displays on flexible substrates, where overall system integration aspects are critical.

Tour of selected groups from the Fraunhofer IAP

Tuesday afternoon several groups from the IAP were visited. The demonstrations included: reinforced cast polyamides, synthesis of new materials for PLEDs and related applications, the materials and device testing laboratory with the cellulose research, and polymer dispersions for coatings. An interesting mixture of topics, where obviously some are linked more strongly to the display application than others. All demonstrations however clearly illustrated the Fraunhofer mission "furthering the trajectory from basic research to applications".

Cast polyamide produced by anionic ring-opening polymerization shows considerably better structure parameters and more attractive material properties than polyamides produced in the conventional way. In most cases this advantage cannot be transmitted to products if the used production process is based on the fusing of polyamide. An elegant alternative is the filling of forms with monomer melts which then polymerize to the desired finished product. On the basis of the existing know-how in moulding, a considerable advantage of this technology is found in the variety of possible products. These cannot be obtained by other processes or would require much input. In contrast to mass production, this process is predestined for smaller production runs. The resulting higher production costs are carried by the market due to the special functional properties of the cast bodies. Gunnar Engelmann show some examples of these materials in the laboratory.

Cellulosic natural fibers have been used as reinforcing fibers for composite materials, e.g. in automotive engineering for a long time. The Fraunhofer IAP, in cooperation with other research institutes, presently works on the development of higher-performance composites with man-made cellulose fibers (rayon tyre yarn) as reinforcing fibers. The aim is to penetrate the sector of glass-fiber reinforced plastics and engineering polymers. Johannes Ganster explain some topics about the testing of these materials

Polymers are almost indispensable as insulating layers, packaging materials, system carriers, capsule materials or adhesives. At present they are also entering the domains of electrical and optical components. Displays, solar cells, integrated circuits, sensors and converters on the basis of semiconductive polymers and polymer electrets allow the integration of microsensors in clothing, disposable circuits in paper, ultrasonic sensors in medicine or intelligent labels. They bring together the

simple and fast processing of polymers with the hightech functions of semiconductors that, up to now, have only been accessible with silicon technology. Thus polymers extend the application of semiconductor technology into areas where the costs, and not the performance of the electronics, are the decisive factor. New device technologies enable extremely flat and flexible designs. In this process the development of cyclic voltammetry for OLED device analysis is just another nice example which was presented by Silvia Janietz.



Silvia Janietz showing the cyclic voltammetry cell for OLED analysis.

Uniformly sized and shaped nano- and micro-particles obtained from emulsion polymerization can organize in highly ordered quasi-crystalline structures. The properties of such self-organized functional materials rather derive from the size, mutual arrangement and surface functionality of the building blocks than from the material composing them. If the size of the structures falls within the range of the wavelength of light, diffraction on the lattice planes of the colloidal crystal results in colour effects. Such effects are well-known in nature from the opal or from structural colors of some butterfly wings. Besides applications for decorative effects in car coating or cosmetics, such materials possess considerable potential for use in optics and optoelectronics as sensor devices, waveguides, optical switches and laser materials. Eckhard Görnitz explain some details of their work in a real laboratory.

The tour provided a view in the Fraunhofer IAP kitchen that was much appreciated by the participants.

Closing remarks

This SID-ME chapter meeting provided clear examples of the high standard of European display material and device research. The conference topic gathered a selection of display specialists that speak a common material and process development language, therefore the discussions reached a highly detailed and informative level. The Fraunhofer IAP, embedded in the science park Golm, provides an inspiring and dynamic place for furthering science from basics to applications. In short, another successful SID-MEC conference.

Gerrit Oversluizen



Coming Events:

International TFT Conference'07 In conjunction with SID MEC '07 Spring Meeting

**25-26 January 2007,
and**

SID-MEC General Meeting CNR Headquarters, Rome, Italy

Topics: LTPS TFT ,Organic TFT, Amorphous silicon TFT, TFT circuits, Display and other system based on TFTs, AM backplane for AMOLED, TFTs on flexible substrate.

**Visit the website for latest information: access via
<http://www.cnr.it>.**

2nd Training Workshop on Flexible Displays Kings College, Cambridge

March 29-30th, 2007

**Visit the website for latest information: access via
www-oe.phy.cam.ac.uk/fet/flexidis_training_index.htm**

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SID payment.

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We encourage our members to pay directly to SID-HQ in the USA, but if they want to pay to the ME-Chapter directly the annual fee should be EUR 70 **with all bank fees covered by the member !**

Please note that due to the change in the US dollar/Euro exchange rate SID-MEC has re-evaluated the membership fee. In case of direct payment to the SID-ME Chapter the payment in EURO should be done to

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Please indicate your name on the remittance papers.

The Newsletter.

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