NEWSLETTER of the SID-MID EUROPE CHAPTER

SID-ME

Nr. 11,
May 2001

SOCIETY FOR INFORMATION DISPLAY

SID-MID Europe Chapter meeting on AMLCD, Micromechanical and OLED Displays at DIMES, Delft University of Technology, Delft / The Netherlands, April 5-6, 2001.

Technical Meeting.

The topic of the technical meeting in Delft was AMLCD, Micromechanical and OLED displays. Over 60 people attended the meeting.

The meeting was opened by Dietmar Theis, SID-ME Director and Ryoichi Ishihara on behalf of the DIMES which hosted the meeting.

Session 1.

The first speaker was *Guglielmo Fortunato (IESS-CNR,Rome, Italy)*. He addressed the excimer-laser crystallisation process for poly-Si TFT fabrication. Excimer-laser crystallization allows the integration of CMOS-circuitry along with AM-switching elements, the manufacturing of active matrix for the AM-OLEDs and system-on-glass. Excimer laser technology is possible due to the UV-absorption of silicon. Therefore Si-film melting can be done without much heating of the glass substrate. The process engineering effort of the last few years on excimer-laser crystallisation has resulted in three process approaches:

1) combined Solid Phase Crystallisation (SPC) combined with Excimer Laser Annealing (ELA). This two-step annealing process is used at Thomson CSF for processing poly-Si TFTs and has a large process window.

2) two-pass crystallisation with use of a mask in the first pass and no mask in the second pass in which the a-Si is melt ed completely without melting the first made poly-Si.
3) The semi-gaussian beam scanning method. This trailing edge method results in large grains and high mobility.

The speaker compared the pros and cons of the three methods and presented a novel fabrication process for poly-Si TFTs with a source/drain definition by a lift-off process.

Francois Plais (THALES LCR, Paris, France) gave a lecture on low temperature poly-Si TFT technology for integrated driver AMLCDs. He mentioned the advantages of poly-Si such as no outsourcing of drivers, reduced size, fewer interconnections. Various aspects of the LT poly-Si technology as used at THALES where discussed: top-gate /self-aligned structures, laser crystallisation, gate oxide deposition (in co-operation with Unaxis), step coverage of SiO_2 by either TEOS or silane, TFT uniformity/reliability.
The final conclusion is that although poly-Si is not as mature as a-Si and includes specific, non-standard process steps, yet LT poly-Si lines are implanted in Japan, Korea and Taiwan.

Barry van Dijk et al. (Delft University of Technology, Delft, the Netherlands) gave a paper on the Single-Crystal TFT by grain-filter location controlled excimer-laser crystallization. In this method it is tried to make a TFT within a single Si-grain, without grain boundaries. The grain filter is a small hole in an insulation layer made by photolithography. Thereafter the hole is filled with a-Si and melted. However still many defects were present in the grains. The poly-Si is grown above the array holes. The method was improved by planarizing the structure and polishing. This results in much less defects and nice characteristics (430 cm^2/Vs, Ion/Ioff=$3x10^8$, Ioff=10^{-13} A .

Mrs.Natasa Tosic (Twente University, Enschede, the Netherlands) presented work on the electrostatic discharge damage (ESD). The ESD comes from people or machines handling TFTs and consists of a few hundred nanoseconds high voltage pulse. In the laboratory the ESD was simulated by using a transmission line model. A stepped TLM stresss was applied to the TFT drain, while the source and gate were grounded. In between 2 TLM pulses the characterisation of the TFT was performed. The change of the Density Of States was studied and compared with several DOS distribution models. It was concluded that the deep states (dangling bonds) were more sensitive to ESD stress.

Session 2

Herbert De Smet (ELIS-TFCG/IMEC, Gent, Belgium) presented several aspects of custom display driver designs. The first example was the design of integrated drivers on microdisplays. For this a high voltage technology is required which consisted of thicker gate oxide and fully customised TFT design including parallelism and redundancy. The second example was the design of drivers for a Cholesteric Texture LC Display. The special driver requirements for this type of display are amongst others: 50V RMS (high power), complicated driver wave forms and special driving schemes. The resulting driver architecture was shown. The important parts are the low power high voltage shifter, analogue switch and the on-chip 3V to 100V DC/DC converter.

Ad Burgmans (Philips Components, BU Biometrics, Eindhoven, the Netherlands) explained the details of biometrics which deals with the automatic recognition of individuals. Fingerprints are one of the possibilities. Main issue is to get a good image quality without requiring much computing power. This is done by using only the bifurcations and the ridge endings of a fingerprint. The main technology of image capture devices is glass with Tactile Sense foil. The latter is a light emitting EL-foil, which emits light but also protects against ESD. The image is detected by an a-Si diode matrix array. The first product made in Philips Components is *ethentica*™ for use as recognition tool in laptop computers.

Bernd Szyszka (Fraunhofer-Institute, Braunschweig, Germany) presented new thin film deposition systems.
The first system is a new transparent conductive oxide. With the well-known ITO and Sb-doped tinoxide the conductivity is due to electron degeneracy with a theoretical limit of 50 mΩcm. At the Fraunhofer IST reactive sputter deposition of Transparent Conductive Oxide films like ZnO-Al was developed in a Leybold A 700 V vertical in-line coater capable for 600 x 1000 mm^2. A survey of achieved film properties of was given. The second thin film material was MgO for use in Plasma Discharge Panels. These films are deposited by reactive gas flow sputtering which is a competitor to reactive DC deposition techniques.

Evening session.

The evening session was devoted to networking and informal

contacts. The location for these important activities was selected with care: a historical building in the old centre of Delft where we enjoyed a nice dinner and good company.

Session 3

The development of Polymer LED monochrome and RGB colour matrix displays for telecommunication was presented by *Robert-Jan Visser (Philips Components, BU Poly-LED)*. After an introduction he discussed the efficiency (> 8 Cd/A at 5000 –100.000 Cd/m^2 for the Y/G Covion material). The lifetime (brightness less than 50% of the original) increase with the MUX ration and is now 120.000 hrs or about 14 years at room temperature. Every 10° temperature increase causes a factor 2 life decrease. They have developed a 1.2" 64 × 96 passive matrix displays with 300 micron pitch which is now qualified for production. This yellow monochrome display has an efficiency of 8-10 Cd/A and showed a life time of > 500hrs at 70° C. The future trend is from small monochrome displays to full colour for mobile phones and even larger displays. Ink jet printing is the route to colour. The resolution is sufficient and the method is fat allowing 1 substrate per 30 seconds. Although lot of work remains to be done good progress is made.

Julian Carter (Cambridge Display Technology, Cambridge, UK) explained the technology basis of the Light Emitting Polymer technology. System approach to development has allowed rapid progress in the life time performance especially of the blue devices. Another example is the development of red emitters for PM displays. A factor 10 in efficiency improvement has been achieved since December 2000. In this way they will contribute to accelerating LEP to Market. An overview of the state-of-the art with R,G,B ,Y and white was given.
At present a prototyping facility with a 600-m^2 floor space is built at Godmanchester. This facility can produce 3000 sheets/month of 350x350 mm^2 glass size.

David Lacey (Osram Opto Semiconductors) gave a talk with the challenging title OLED technology potential: separating the Facts from the Hype. Therefore he discriminated between real displays from manufacturing line and demo displays from a pilot line. He mentioned several companies with demo displays and other companies with real displays such as Philips, Osram Opto and Delta. Then he reviewed the colour OLED status with both small molecules and polymers. Differential aging determines the display lifetime. Interesting comparison is the cost of the production for PM-OLED versus the STN-LCD and the Small Molecule systems versus Polymer systems. The major conclusion is that ultimaterly the one with the better yields will win. Osram Opto Semiconductors has a PLED factory in Penang , Malaysia.

Session 4

Mark Johnson (Philips Research, Eindhoven, The Netherlands) talked about Active Matrix Poly-LED Displays. In passive matrix Poly-LED technology the current lines is used for charging capacitors, resistive loss and light production. For larger panels charging and resistive losses become predominant and therefore Active Matrix addressing is to be preferred. All pixels will be provided with a switch in the latter case and will emit continuously light so that the driver current can be reduced and lower resistive losses will be obtained. The performance of the driving TFT greatly determine the light output. With analogue driving the display uniformity might be an issue e.g. due to variation in poly-Si Active Matrix characteristics. Good results will be obtained with digital addressing instead of analogue addressing so that the drive transistor can be either full on or full off. In this case variation in poly-Si TFT characteristics will cause no non-uniformity although this might give a grey scale issue.
A self-compensating single TFT Current Mirror is the latest new development.

Edzer Huitema (Philips Research, Eindhoven, The Netherlands) gave a presentation on the use of polymer electronics as pixel switches in AMLCDs. The ultimate goal is use e.g.spin coat technologies on a flexible plastic substrate as a fast route to manufacture AM-LCDs. The technical back-ground of the polymer AM-LCD was explained. The first lay-out is a conventional bottom gate TFT with an organic semiconductor combined with a PDLC material. Some remaining issues were low mobility of charge carriers and life time. Recent progress has shown stable TFTs, high contrast ratio and no pixel errors. A new breakthrough has demonstrated greyscale capability due to improved Ion/Ioff > 10^4.

Serhat Sakarya (Delft University of Technology, Delft, The Netherlands) gave a lecture on the modulation principle of mechanical microdisplays. The modulation can be done by the varying the tilt of the reflector like the DMD of Texas Instruments. At the Technical University of Delft they use the curvature modulation of the reflector as the major principle. The reasons for this development are : simple and cheap, 100% fill factor, high optical quality and capability of handling high optical load. There are 2 approaches:

a) pixelated SiN membranes resting on a support grid over an electrode structure with a pixel range of 100 -1000 micron and switching voltages from 0 -30V.
b) Visco-elastic layers: the reflective layer rests on elastic material. This lay-out needs no structural pixelation but require a bias of 150V and 30V switching voltages.

Functional pixelated membrane test devices were made using 64x64 pixel active silicon backplanes.

SID ME Chapter meeting

The treasurer Frank Rochow had a positive message on our financial status. It was remarked that the SID-Me chapter should work on more visibility by advertising and a homepage on the web. There was a proposal to have stipends for students to enable them to visit SID meetings. Next chapter meeting will be on October 11 and 12, 2001 at Schott Glass in Mainz, Germany.

Guided Tour through the DIMES facilities.

After the technical programme of the meeting the Prof.C.I.M.Beenakker gave an overview of the Delft Institute for Microelectronics and Submicron Technology. Thereafter we were guided along the technical facilities to have a look with our own eyes.

Jaap Bruinink

From the SID ME Chapter Officers:

The Spring ´01 SID Mid-Europe Chapter Meeting at the Delft University of Technology was a full success in every respect. We wish to thank our colleague Jaap Bruinink from Philips for the careful selection of speakers as well as the effective co-ordination and co-operation with our hosts from the Delft University. Here we would like to highlight the substantial work done by Ryoichi Ishihara from the Delft Institute of Microelectronics and Submicron Technology (DIMES) who was a perfect host, including the impressive tour of the institute.

We also would like to thank all authors for their concise and timely presentations and we hope that they too feel rewarded by the very positive echo we have heard throughout the conference. The fun of riding a horse-tram to the traditional restaurant with its excellent dinner and wine was in no way impaired by the April rain. And since every participant was eager to join the party of display experts nobody could be stopped by the railway-workers who were on strike!

Thank you all, we now have added some more nice knots to our network!

D. Theis

S I D – M E

Coming: SID-ME Chapter Fall 2001 meeting.

Topics will be Display Materials and Components.

The next SID-ME Fall Meeting is scheduled to take place on
October 11 and 12, 2001
at Schott Glas in Mainz, Germany.

You are kindly invited to submit papers for this meeting and to mark your calendar.

More details will become available during August / September 2001.

The SID-ME Chapter committee is now formed by:

Lic.Tech. J.Kimmel (chair), Nokia Research Center, P.O. Box 100, FIN-33721 Tampere, Finland,Tel.: +358 7180 35484, Mobile: +358 40 580 8967, Fax: +358 7180 35322,
E-mail: jyrki.kimmel@nokia.com

Dr.J.Bruinink (vice-chair), Philips Research, Prof. Holstlaan 4, 5656 AA, Eindhoven, The Netherlands, Tel.: +31 40 2743989, Fax: +31 40 274 43 35,
E-mail: Jaap.Bruinink@philips.com
Prof.Dr. A. van Calster (secretary), University of Gent, St.-Pietersnieuwstraat 41, B-9000 Gent, Belgium, Tel.: +32 9 264 33 90, Fax: +32 9 264 35 94,
E-mail: vancalster@elis.rug.ac.be

Dipl.Ing. F. Rochow (treasurer), LMT Lichtmesstechnik GmbH, Helmholtzstrasse 9, D-10587 Berlin, Germany, Tel.: +49 30 393 40 28, Fax: +49 30 391 80 01,
E-mail: rochow@lmt-berlin.de

Additional members of the SID ME Chapter committee are:

Dr.-Ing. M.E. Becker, Autronic-Melchers GmbH, An der Rossweid 18, D-76229 Karlsruhe, Germany, Tel.: +49 721 962 64 44, Fax: +49 721 962 64 85,
E-mail: autronic-melchers@t-online.de
Dr. W.Becker, Merck KGaA Frankfurter Str. 250, D-64293 Darmstadt, Germany,Tel.: ++49 6151 72 7360 ; Fax: ++49 6151 72 3132
E-mail: werner.becker@merck.de
Prof.Dr.-Ing. E. Lüder, University of Stuttgart, Pfaffenwaldring 47, D-70550 Stuttgart-Vaihingen, Germany, Tel.: +49 711 68 57 330 or +49 711 68 57 332, Fax: +49 711 685 7311,
E-mail: ernst.lueder@ins.uni-stuttgart.de
Prof.Dr. P. Maltese, University La Sapienza,Via Marmorata 169, I-00153 Roma, Italy, Tel.: +39 644 585 428, Fax: +39 647 42 647.
Dr. M. Schadt, Rolic Research Ltd, Gewerbestrasse 18, CH-4123 Allschwil, Switzerland,
Tel.: +41 61 487 22 22, Fax: +41 61 487 22 88, E-mail: martin.schadt@rolic.com
Dr.P.G.Wierer, Balzers Thin Films, P.O. Box 1000, FL-9496 Balzers/Liechtenstein Tel.: ++423 388 47 42, Fax: ++423 388 54 05
E-mail: wip@btf.balzers.net

European officers of the SID:

Prof.Dr. A. van Calster , Regional Vice-President Europe, University of Gent, St.-Pietersnieuwstraat 41, B-9000 Gent, Belgium, Tel.: +32 9 264 33 90, Fax: +32 9 264 35 94,
E-mail: vancalster@elis.rug.ac.be
Dr.-Ing. D.Theis, Director, Mid-Europe Chapter, Siemens AG, ZT MuK, Otto-Hahn-Ring 6, D-81730 Munich, Germany,
Tel.: +49 89 636 405 50, Fax: +49 89 636 405 54,
E-mail: dietmar.theis@mchp.siemens.de

SID payment.

The SID annual membership fee amounts US$ 75. Please note that the membership is now a rolling membership, which means that it runs 12 months from the month in which the payment was made. For more information see the SID web-site www.sid.org.
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 90 with all bank fees covered by the member !
In case of direct payment to the SID-ME Chapter the payment in EURO should be done to

Account no.:	206 020 1104
at:	Berliner Sparkasse, Berlin,Germany
Bank code:	BLZ 100 500 00
Account name:	Frank Rochow, SID-ME

Please indicated your name on the remittance papers.

The Newsletter.

If you want to place an article in the Newsletter, which is interesting for the European display society, please send it to: J.Bruinink, fax: +31 40 274 4335,
E-mail: Jaap.Bruinink@philips.com