SEMICON® EUROPA OCT 25–27, 2016 GRENOBLE, FRANCE CONNECT

2016FLEX Europe

J. Gavillet
EU Program Manager
CEA, GRENOBLE, France

Biography
Dr. Jérôme GAVILLET received his PhD on material physics & surface processing from l’Ecole des Mines de Nancy (F) in 1996. As a researcher, he worked on hydrogen embrittlement of stainless steels for the petrol industry at the Federal University of Rio de Janeiro (B), on zircaloy alloy coatings for the French nuclear industry and on copper interconnects for the semiconductor industry at the University of York (UK). He spent 7 years in microelectronics working as a process engineer for equipment suppliers in Cardiff (UK), Sunnyvale (US) and Grenoble (F). He joined CEA-Liten in 2005 as a project manager in the field of Renewable Energies and Nanomaterials, working on surface energy and thermal management topics. Since 2012, he works as an European program manager, contributing to the management of CEA-Liten’s EU projects portfolio and setting up new business opportunities in the fields of materials, renewable energies, energy efficiency and information & communication technologies. He has authored 10 patents and over 40 publications (H-index=9, August 2015).

Welcome

L. Altimime
President
SEMI Europe, Berlin, Germany

Abstract
We would like to welcome you to the 2016FLEX Europe conference during SEMICON Europa.

Biografie
Laith Altimime joins SEMI as president of SEMI Europe, as of October 1, 2015. He has more than 25 years of international experience in the semiconductor industry. Most recently, Laith held a senior director position in business development at imec. Prior to that, he held leadership positions at Infineon/Altis, Qimonda, KLA-Tencor, Communicant Semiconductor AG, and NEC Semiconductors. Laith holds a Honors Bachelor's Degree in Applied Physics and Semiconductors Electronics from Heriot-Watt University in Scotland.

Powering a Flexible world - Thin and printed power storage

P. Hiralal
CEO
Zinergy UK Ltd., Cambridge, United Kingdom

Abstract
Zinergy turns the traditional alkaline battery into a thin (<0.5mm), flexible and low cost form by using printing technologies. In addition, its unique electrode design allow for better performance and rechargeability, in a completely safe and environmentally benign design.

The last decade has shown a large development in the areas of flexible electronics and Internet of Things (IoT). New electronics and materials are permitting designers to produce a wide array of devices. Many new concepts are being tested, from ubiquitous sensors, to wearable devices. Some will succeed, some will fail, but the fundamental development behind these devices are around to stay.

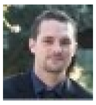
However, one particular area, the battery, has not developed as fast as the rest. The power source for these remains in the old traditional bulk form. As a result of strict packaging requirements, the battery still maintains the classical case form factor, and poses a design limitation for many design concepts. There is an urgent requirement for thin, flexible energy storage devices which can conform with different device sizes and shapes.

Emerging topics such as wearable technology and IoT require some different parameters for the battery, such as ultra-thinness, small physical footprints, flexibility and light weight which are becoming increasingly prized.

The classic zinc battery is by far the technology with the highest number of batteries shipped, principally due to its low cost. We translate this well known battery technology into a flexible, printed form factor, and add a few materials innovations to improve performance and improve on rechargeability, opening potential for a thin printed battery which can be produced at a low enough cost that make it suitable for high volume applications.

Biografie
Dr. Pritesh Hiralal is the founder and CEO of Zinergy UK Ltd. Before this, he was a Research Associate as well as an adjunct lecturer at the University of Cambridge, where he completed his Ph.D. at the department of Engineering at Cambridge University. He has spent time in business in Spain and set up Zendal Backup. He has spent time in industry at the Nokia Research Centre working on high power energy storage where he holds several patents under his name. He has specialised in understanding the growth of nanomaterials and the application of these into different architectures for photovoltaics and energy storage devices including batteries and supercapacitors. He has published 30+ papers and 8 patents in the field. He has completed a number of consulting assignments in the energy storage industry, for materials as well as device companies.

A flexible and invisible printed electronic



Y. Bohard
Innovation & Business Development Manager
Genes'Ink, Rousset, France

Abstract
Since its creation in 2010 in Rousset (south of France), Genes'Ink works to build a flexible, lightweight and connected electronic.
Based on patented innovation, Genes'Ink offer today material to print conductor and semiconductor.
This technology enables our customer to print photovoltaic cells, OLED surface, 3D antenna and flexible circuits.
Our technology allow to print really thin conductive grid – almost invisible (90% transparency).

Biografie
Yohann BOHARD - Innovation & Business Development Manager
10 years of experience in business development in electronics.
Graduate from engineering school of Sophia-Antipolis (Polytec'Sophia).

How flexible electronics will improve patient's daily life? SUBLIMED, end user point of view.

N. Karst
CEO
SUBLIMED, 38430, France

Abstract
SUBLIMED develops a medical device, actiTENS, targeting the chronic pain market, which concerns 1.5 billion people worldwide. actiTENS is based on a proven non-drug therapy, transcutaneous electrical nerve stimulation (TENS).
Conventional TENS devices take the shape of a voluminous casing (hand carried, attached to the belt or worn around the neck), tied with cutaneous electrodes through long cables causing physical and psychological embarrassment which highly compromises the adoption of the TENS by patients. actiTENS® offers a miniaturized, thin and flexible device, which is directly worn on the body adapting itself perfectly to the morphology of each patient. Easily hidden under clothes, wirelessly monitored by smartphone, actiTENS® discreetly supports patients in their daily activities.
In order to better adress patient's needs in terms of discretion and ergonomics, the next generation of wearable medical devices should be as thin and as flexible as possible. Conventional electrical components (printed circuit boards, batteries...) do not fulfil end user requirements and therefore should be revolutionized. Through a concrete example, SUBLIMED will expose some of the end user needs in the field of wearable medical devices to turn conventional devices into Band-Aid like devices.

Biografie
Nicolas Karst is graduated with a PhD in process engineering from Grenoble INP. After a first professional experience at STMicroelectronics, he joined the CEA where he supervised the innovative STIMFLEX project leading to the creation of SUBLIMED. Nicolas has been awarded by several innovation contests (including the National Contest for “Assistance to the Creation of Innovative Technology Companies” organized by French Ministry of Higher Education and Research). He also followed several entrepreneurial trainings including the famous training dispensed by HEC (HEC Challenge+).

M. Ciesinski
President, Flextech Group
SEMI/FlexTech, San Jose, United States

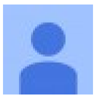
Biography
Michael Ciesinski is President of FlexTech Alliance, SEMI’s first Strategic Association Partner. FlexTech is an R&D consortium chartered with building the infrastructure for flexible electronics manufacturing. Ciesinski’s prior executive positions include President/CEO of US Display Consortium, and Vice-President and Director of North American Operations for SEMI. Prior to joining SEMI, Ciesinski was appointed Director, New York State Labor-Management Committee.

FlexTech sponsors and conducts a multi-million dollar technology development program. In February 2012, FlexTech created the Nano-Bio Manufacturing Consortium (NBMC), focused on human performance monitoring. In August 2015, FlexTech was awarded a $75M US Government grant to form and manage a Flexible Hybrid Electronics Manufacturing Innovation

Institute (Next Flex).

Ciesinski is a graduate of the State University of New York at Albany. He is a member of the Dean’s Advisory Council (Engineering) at the California Polytechnic State University at San Luis Obispo.

EU's activities to support research and innovation



N. Kyrloglou
Programme Officer
European Commission - Unit for Competitive Electronic Industry (DG Connect), Brussels, Belgium

Abstract
The EU supports the development of flexible and hybrid electronics technologies and products and has a prioritised this as an area for public financial support under the EU Horizon 2020 funding program. During this presentation, the European Commission, who manages the manages the allocation of EU funding, will outline the EU's activities to support research and innovation in the area of 'Thin, Organic and Large Area Electronics' and provide insight on how companies can benefit from the public funding that is available.

Biografie
T B A

OLED for Automotive Applications: Status and Future Trends

E. Lang
Senior Key Expert OLED Technology
OSRAM OLED GmbH, Material and Technology,
Regensburg, Germany

Abstract

In the past few years substantial progress has been made in the development of organic light-emitting diodes for general illumination and for automobile applications. In this talk, the main drivers for OLED automotive lighting as well as its main differentiators from other automotive lighting solutions will be discussed. To take advantage of these differentiators, technology barriers for OLED need to be overcome. In this regard the requirement profile for automotive applications is compared to the requirements for general illumination. Rigid, glass-based OLED now meet entry level automotive reliability requirements and are entering the automotive market as tail lights in first series production vehicles.

In the future, flexible OLED is expected to be the main differentiator for OLED in automotive applications, since the integration in 3D-shaped OLED modules enables completely new design possibilities for automotive lighting. We will highlight examples for innovative 3D-shaped OLED designs and present the recent progress on flexible OLED technology. Last but not least, the results of the latest development towards sophisticated 3D-OLED for tail lights will be discussed.

Biografie

Dr. Erwin Lang is Senior Key Expert for OLED Technology at OSRAM OLED GmbH with more than 10 years of experience on OLED technology for lighting applications. He has successfully led various development projects covering many aspects of OLED device and processing technology. Moreover he has been work-package leader in several completed and ongoing German and EU-funded projects.

Market trends in printed and flexible electronics

G. Chansin
Technology analyst
IDTechEx, Cambridge, United Kingdom

Abstract

IDTechEx has been tracking the progress in printed, organic, and flexible electronics since 2001. This presentation will give an overview of the key market segments which include flexible displays but also sensors and wearables.
Since sensors typically have a much simpler structure than displays or logic circuits, the manufacturing learning curve can be less steep compared to other devices. In most cases, these sensors can also be made on plastic substrates, offering the advantages of mechanical flexibility, thinness and light weight. Recently, there has been a lot of interest in integrating electronics in textiles (e-textiles), where flexibility is essential.

Biografie

Dr Guillaume Chansin is a senior analyst for IDTechEx Research. Based in Cambridge (UK), he interprets the latest trends and market data in printed electronics, sensors, flexible displays and wearable electronics. He is fluent in French and English and gives presentations in both languages. Guillaume obtained a degree in Physics Engineering from INSA Toulouse, followed by a PhD in Chemical Physics at Imperial College London. Before joining IDTechEx, he worked on flexible e-paper displays at Plastic Logic.

M. Hack
VP of Business Development
Universal Display Corporation, Ewing, United States

Biografie

Dr. Michael Hack, is Vice-President of Business Development at Universal Display Corporation. He is responsible for developing and commercializing advanced high efficiency next generation OLED products, with a special focus on flexible display applications and solid-state lighting. Prior to joining UDC in 1999, he was associated with dpiX, a Xerox Company, where he was responsible for manufacturing flat panel displays and digital medical imaging products based on amorphous silicon TFT technology. Dr. Hack received his Ph. D. degree from Cambridge University, England in 1981 and in 2007 Dr. Hack was elected a Fellow of the Society for Information Display. In 2014 Dr. Hack was nominated to serve on the board of the U.S. OLED Lighting Coalition to promote the advancement and commercialization of OLED lighting.

Application of Flex Substrate in Subretinal Implant

S. Rudorf
Deputy Manager R&D
Retina Implant AG, Reutlingen, Germany

Abstract

Some people suffer from blindness due to a hereditary disease, retinitis pigmentosa. It results in the gradual degeneration of the photoreceptor cells. The remaining retinal network, however, stays intact. In the case of the presented implant, the function of the degenerated photoreceptors is replaced by a microchip, consisting of a 2-dimensional array of photodiodes and electrodes. The subretinal implant resumes the same place as the degenerated photoreceptors. Hence, the remaining retinal network is employed for natural signal processing.

Mounted on a carrier, the retinal chip is placed intra-ocularly. To provide the chip with energy, the chip carrier is connected to a subcutaneous supply unit. It contains a coil for inductive coupling to an external unit. All implant components have to be biocompatible. A further requirement of the chip carrier is flexibility, due to the implantation procedure and the curvature of the eye. Further-more, the chip carrier has to be long-term stable in a saline environment: a low water vapor permeability is essential as well as good adhesion of the carrier layers.

The material of the presented chip carrier is polyimide with gold traces. The signal assignment is chosen such that neighboring potential differences are kept low. Additionally, intermediate conducting traces with high impedance are implemented, which significantly improves the long-term stability of the implant.

Though polyimide represents a good barrier, conductive electrolyte solution from the human body permeates the metallic structures beneath the polyimide after a prolonged period of operation. This leads to the seemingly sudden failure of the implant in the patient. Hence, the topic of permanent implant functionality in clinical practice has to be addressed. Based on the international standard ISO 5841, the product failures observed during clinical use are analyzed statistically. The implemented procedure provides the cumulative survival rate as key figure.

Biografie

Sandra Rudorf received the Dipl.-Ing. and Dr.-Ing. degree in electrical engineering from the University of Stuttgart, Germany, in 2005 and 2012, respectively. At the end of 2011, she joined Retina Implant AG, Reutlingen, Germany, as Project Manager for Medical Electronics. Since April 2016, she is Deputy Manager of the R&D department.

Flexible Hybrid Electronics for Aerospace Applications

B. Leever
Materials Engineer
Air Force Research Laboratory, AFRL/RXAS,
Wright-Patterson AFB, United States

Abstract

Flexible Hybrid Electronics (FHE) are expected to impact a range of aerospace applications including: wearable electronics and sensors for monitoring airman health/performance; conformal electronics and antennas for maximizing space efficiency and reducing aerodynamic drag; and inherently more durable circuits that will withstand the extreme strain, shock, and vibration environments typical of aerospace missions. The presentation will highlight our work in the development flexible devices as well as their integration with both rigid and flexible components through FHE packaging concepts. Our work includes the development of flexible and foldable lithium ion batteries based on carbon nanotube current collectors, which have been shown to be compatible with both roll-to-roll and direct-write fabrication approaches. We will show that these batteries offer the potential to significantly reduce electrode weight while maintaining equivalent electrochemical performance and dramatically improving mechanical resiliency.

In addition, the presentation will discuss strategies for improving the survivability of electronics in high-shock environments. This work includes innovative packaging schemes for protecting traditional electronic components on PCBs such as encasing them in elastomers as well as investigating the deposition of flexible Si integrated circuits with stretchable interconnects on soft substrates. Finally, the presentation will detail our work in liquid gallium alloys for stretchable and reconfigurable electronics. Recent work has focused on aerosol jet and extrusion-based approaches for printing liquid gallium alloys as well as approaches to mitigate gallium oxide formation to improve opportunities for the development of reconfigurable antennas.

Biografie

Benjamin Leever is currently a Senior Materials Engineer in the Air Force Research Laboratory (AFRL) Soft Matter Materials Branch. His primary roles are Portfolio Lead for Airman Performance Monitoring and Government Chief Technology Officer of NextFlex, America’s Flexible Hybrid Electronics Innovation Institute. In support of AFRL’s investments in Airman Performance Monitoring & Aeromedicine, Dr. Leever determines technical strategy, manages AFRL contracts, and establishes industrial, academic, and governmental collaborations. He also leads the directorate’s Energy Integrated Product Team and respresents the directorate on numerous domestic and international power & energy and additive manufacturing working groups.

Prior to assuming his current duties, Dr. Leever led a research team focused on the development and modeling of multifunctional materials for structural power applications. Dr. Leever began his career at AFRL in the Manufacturing Technology Division, where he managed programs related to electro-optics systems. He earned a B.S. in Chemical Engineering from the University of Cincinnati and a Ph.D. in Materials Science & Engineering from Northwestern University.

Innovative automotive door-handle based on R2R printing process, hybrid and heterogeneous integration

J. Herrán
Project manager
IK4-CIDETEC, Sensors Unit, San Sebastian, Spain

Abstract

Aesthetics is one of the key factors that determine the evolution of the automotive sector, which need to correspond to visual appearance as well as to ergonomic functionality and utility features. Nowadays, the vehicle interior market demands both visual and functional renovation as well as its integrated electronic devices. Actually, the needs of the driver are covered by a technology based on mechatronic concepts, which has with limited functionality and makes difficult that the aesthetic evolves at the same pace as the market.

Organic and Large Area Electronics (OLAE) is able to trigger innovation in different sectors, such as traditional industries (paper, plastic, printing and textile) to delivers novel cost-effective integration solutions to the traditional electronics sector.

In this context, Roll-Out project (funded by H2020 TOLAE program, 2015-2017) is developing a new concept of automotive door-handle based on OLAE, which will enable enormous value addition to European Automotive industry without adding any significant extra cost. In particular, pressure sensors patented by IK4-CIDETEC (RTD partner), mostly based on interdigitated metal electrodes with several functional layers on top, have been scaled up to R2R process. The printing process has been developed by the Maxi Printed Intelligence R2R pilot line at VTT (RTD partner). The first functional prototype consists of a resistive sensor matrix formed by a 2x4 array with a tactile unit of 1 cm^2. After printing process and sensor assembled, resistors have been bonded by an automated pick-and-place system (hybrid integration).

The final step is focused on heterogeneous integration by overmolding process. MAIER (End-User, TIER-1 automotive supplier partner) with the support of VTT has design and developed the new mold, according to automotive manufactures requirements. Different thermoplastics have been tested and injection parameters have also been optimized (pressure, temperature, speed, etc).

Biografie

Dr. Jaime Herrán received his first class honours degree in Physics at the University of Cantabria in 2004 and his PhD at the University of Navarra in 2008.

He was working at the communication engineering department of the University of Cantabria (2003-2004), the Microsystems unit of the CEIT and Tecnun, University of Navarra (2005-2010) and in 2008, he was working as a postdoc research & development scientist at the Microsystems Technology division of the CSEM in Neuchâtel (Switzerland). Since 2010, he is a researcher and a project manager of the Sensors Unit at IK4-CIDETEC, San Sebastián, Spain.

He is specialized in solid-state microsystems (physical and chemical sensors), coatings technology (PVD, CVD and printing processes) and nanotechnology. He is co-author of more than 45 articles in international journal and conferences (h-index=8). He has taken part in both industrial and research projects under national and international programs.

Large area printed piezosensors for wearable applications

T. Grunemann
PhD student
Fraunhofer ISC, Würzburg, Germany

Abstract

Due to demographic changes the number of older employees, who want or have to work but are already physically limited, increases. At the same time the number of workers in medical care is insufficient to meet the demand as the society gets older. In consequence, there is strong interest in sensor technologies by employers and medical professionals in terms of safety-at-work and point of care technologies which can measure, support and guide the movement of body parts with simple-to-use techniques. Camera-based technologies however can be used at pre-defined locations, only, and, might cause difficulties regarding data protection.

In this contribution, we present a sensor technology which can be integrated on textiles in order to measure movements of a human body by wearing a special shirt. At first, the sensors are designed to measure the bending and twisting of elbow and wrist joints. The technology is based on printable piezoelectric sensors realised by PVDF derivatives and PEDOT:PSS electrodes and processed by simple screen-printing techniques at low temperatures. The freedom to design the size and the shape of the sensors result in the feature that the sensors can be optimally tuned to the measuring task. Due to the fact that the sensors are designed as integrating large-area sensors, it is not necessary to position the sensors exactly.

Printing the sensors on textiles instead of foils causes some difficulties in terms of quality and stability of the sensors. Measures to tackle that are pointed out. Technologies to realise a hybrid assembly technology and electronics for read-out of the sensor signals are sketched. Finally, measurements of bending signals, which are in the size of mVs and show linear characteristics, are discussed.

Biografie

Large-Area Electronics: a new way of making electronics, to enable the IoT and wearable electronics industry

L.G. Occhipinti
Principal Research Associate, Outreach and Business Development Manager
University of Cambridge, Department of Engineering, EPSRC Centre for Innovative Manufacturing in Large-Area Electronics, Cambridge, United Kingdom

Abstract

Large-Area Electronics, including printed, plastic, organic and flexible electronics, is a new way of making electronics that: i) is enabled by new materials that can be processed at low-temperatures; ii) enables the use of new manufacturing processes for electronics such as printing and digital fabrication; iii) enables products having new form factors, the potential for customisation and new cost structures and iv) includes integration with silicon in non-traditional form-factors.

Since Oct. 2013 the EPSRC has funded a Centre for Innovative Manufacturing in Large-Area Electronics within its portfolio of “Manufacturing the future” initiatives, to work with industry and academia, which is led by the University of Cambridge, in collaboration with the University of Manchester, Imperial College London and Swansea University .

The mission of the EPSRC Centre is to tackle the technical challenges of multi-functional system integration of large-area electronics (LAE) in high growth industrial sectors through an innovative programme of manufacturing research, in a strong partnership with both industry and academia.

The EPSRC Centre is up and running and, so far, has a total of 27 projects in its Technical Programme portfolio of both Centre-funded and externally funded projects.

The talk will give an overview of the innovation activities and latest results achieved in the EPSRC Centre, with main focus on manufacturing technologies for IoT and smart wearables, including a new class of power-efficient energy harvesting and storage.

The talk will also outline recent activities developed in Department of Engineering at Cambridge in the field of bioelectronics and fibre-based electronics, towards a new generation of e-textile based products, which led to the recently awarded €9 million H2020 project 1D-NEON “1D Nanofibre Electro-Optic Networks”, involving 14 European partners and coordinated by the University of Cambridge.

Biografie

Since April 2014 Dr. Luigi G. Occhipinti is member of the University of Cambridge, Electrical Engineering Division, and National Outreach Manager of the EPSRC Center of Innovative Manufacturing for Large Area Electronics (www.largeareaelectronics.org). He is also Founder and Director of Engineering at Cambridge Innovation Technologies Consulting Limited (www.citc-ltd.co.uk), a start-up company built to innovate the healthcare and medical sector. He has 20 years of experience driving research and innovation in the semiconductor industry, pioneering the field of post-silicon technologies, including development and applications of: organic and printed electronics, MEMS and bio-MEMS devices, graphene-based flexible electronics, smart sensors and systems heterogeneous integration, chemical and bio-sensors for personalized diagnostics and therapeutics.

Prior to moving to the UK, Luigi was R&D Programs Director and Senior Group Manager at STMicroelectronics (www.st.com), a global semiconductor company, where he was in charge of multidisciplinary research teams and new business development based on Heterogeneous Integrated Smart Systems, Flexible and Disposable Electronics and New Sensors technologies. He has authored and co-authored over 85 scientific publications and 37 patent families (H-index 18).

He is recognized expert in the field of printed, organic and large-area electronics and integrated smart systems, and has been Principal Investigator of multiple EC-funded programs in the areas of Information and Communication Technologies (ICT) and Nanotechnologies, advanced Materials and Production (NMP). Dr. Occhipinti has been member of 2 IEEE (P1620, P1620.1) and 3 IEC standardization technical committees (TC105, TC111, TC113), and served: i) as executive committee member, the Italian District for Polymeric and Nanocomposite materials (IMAST) from 2010 to 2014, ii) as scientific committee and advisory board member, 3 EC-funded European projects in the field of micro and nano-robotics and Organic and Large-Area Electronics, iii) as external expert, assisting the EC in progress review of funded projects in the area of large-area electronics and solid-state lighting, and iv) as non-executive director and scientific committee member, innovative startups in the field of printed electronic materials and energy storage.

PI-Scale – a European pilot line for flexible OLEDs

C. Keibler
european project leader
Fraunhofer FEP, Flexible organic electronics,
Dresden, Germany

Fraunhofer FEP

Abstract
PI-SCALE is a Horizon2020 project, which is an European collaboration to create an open access pilot line service offering world class capability in customised flexible organic light-emitting diodes (OLEDs) in order to accelerate the commercial adoption of this technology. The project brings together Europe's experts and state-of-the-art infrastructure for flexible OLED fabrication, and enables companies to quickly and cost effectively test and scale up their flexible OLED lighting or signage concepts and bring them to a level where they are ready to be transferred to a mass production facility.
Flexible OLEDs are ultra-thin (<0.2 mm), highly bendable, very lightweight, and even transparent energy efficient large area, patternable light sources. They can be made or cut to any shape or size, and can be integrated into formed components or seamlessly bonded onto curved surfaces. The commercialisation of this technology will open up a host of exciting design opportunities to create new value adding lighting and signage products in many different application areas such as architectural lighting, automotive, aerospace and consumer electronics.
The pilot line is positioned to bridge the gap between R&D and mass production, and provides independent, open access services including:
• Prototyping and pilot production of customised flexible OLED devices (up to 5000 m^2 of OLEDs/year)
• Up-scaled materials, process and equipment testing
• System-level integration of flexible OLEDs into products
• Application-specific operational testing
• Advice and "hands-on" workshops to introduce companies to flexible OLED technology

Biografie
Claudia Keibler studied mechanical engineering with the focus on manufacturing engineering at Technische Universität Dresden. After her studies she graduated in the field of adhesive bonding as European Adhesive Engineer. She has been working at the Fraunhofer since 2010 in the field of flexible organic electronics. Claudia Keibler has a strong expertize in atomic layer deposition technique and in adhesive bonding technologies. Since 2013 she is working as a European project leader and coordinator at Fraunhofer FEP.

Printed Circuits Prototyping Platforms for Flexible Sensor Systems

V. Fischer
Research Engineer
CEA, Liten, Grenoble, France

Abstract

This paper presents the methodologies developed at CEA-LITEN for design of flexible sensor systems. In order to evaluate the potential of printed devices for innovative system and drive technology accordingly to application requirements, 4 prototyping platforms have been set-up focusing efforts all-along the chain of skills.

Focus will be given on the “Design platform for Circuit & System prototyping” enabling evaluation of technology upon flexible sensor systems requirements. For this purpose silicon methodologies have been adapted to provide a Design Kit available in Cadence Virtuoso format. It includes Sensor and N/P-type Organic Transistors compact models for DC and transient mode, as well as standard EDA tools (DRM, LVS, DRC). Characterization of fabricated analog and digital circuits is presented (logic gates, flip-flops, amplifiers, ADC, RFID circuits, multiplexing circuits, active matrix with embedded gate drivers). A focus on the expected functions for sensor interfacing and pertinent segmentation with silicon IC will be discussed. The talk will also illustrate how prototyping at system level drives the specifications on material development. The choice between PMOS and CMOS technology will be discussed regarding application and integration challenges. Simulation on relevant application case will also highlight performance requirements (reproducibility, current, speed, operation voltage). The impact for the choice of semiconductor and dielectric and the solution under study on the R&D platform for “Integration of Advanced materials” will be presented.

Finally the challenges towards industrialization will be discussed with an overview on the tools and methods employed respectively on the “PICTIC printing Pilot line” dedicated to scale-up of printing process at GEN1 and on the “Characterization Platform and Reliability Lab” dedicated to evaluation of device performance, yield and ageing stability in order to support Technology Readiness scale-up (TRL4-7).

Biografie

Vincent Fischer obtained an MS degree in Electrical Engineering in 2001 and a PhD degree in Electrical Engineering in 2004, both from the Grenoble National Institute of Technology (INPG). He has been working in the field of silicon microelectronics, holding various positions at design houses and EDA supplier companies, before moving to printed and organic electronics since 2010. He is currently working in the Printed Electrical Component Laboratory, focusing on device physics, electrical characterization, compact modeling and design kit production. He is also interested in the field of volatile and non-volatile memories, and more specifically SRAMs. He is co-author of more than 30 papers in international publications and conference proceedings.

Organic Electronics: Photolithography or Printing?

G. Lloyd
Senior Manager, Marketing
Merck, Southampton, United Kingdom

Abstract

Production processes for large area electronics are traditionally dominated by photolithography. This is obviously driven by the huge markets for displays and photovoltaics and hence significant investment has been made into the manufacturing infrastructure. For new technologies to gain any sort of foot hold in these markets, they will need to tap into this infrastructure and show compatibility. Printing is now emerging as a candidate for lower cost manufacturing with potential for greater customisation, particularly in digital printing. Recent activity in printed OLEDs for displays is an excellent example. For the transistors and by example, the backplanes of displays, there is also interest in both processes. Photolithography processes to enable access to the existing manufacturing infrastructure but also printing processes to ultimately realise the dream of fully printed roll-to-roll electronics that will drive the mega trends of ubiquitous electronics and the Internet of Things. In this paper we present formulation and process development for photolithography of OTFTs for integration in display application and fully printed OTFTs for Printed Electronics. The photolithography process includes optimised ink formulations and processes using standard commercially available photoresists, as used in FPD manufacture. This represents a clear step forward in compatibility with the existing manufacturing infrastructure and hence, is closer to real commercial production. The printing process includes optimised semiconductor and dielectric inks for gravure printing. All layers are developed for print performance, compatibility with previous layers (orthogonality, wetting etc.), and electronic performance. We present our latest data on development of both processes which clearly demonstrates that Merck materials are ready.

Biografie

Dr. Giles Lloyd has worked in the field of organic electronics for 20 years. He received a PhD from the University of Liverpool in solid state electronics. For the last 14 years he has worked on Organic Electronic material and process development at Avecia and more recently, Merck. His role involved material development and device optimization which led on to international customer project management. He has led the global business development activities in organic electronics and photovoltaics and his current role involves leading the Strategic Marketing activities in the field of Hybrid Electronics at Merck.

A. Kemppainen
Key Account Manager
VTT Technical Research Centre of Finland, Oulu, Finland

Biography

Antti Kemppainen is currently working as Key Account Manager for VTT Technical Centre of Finland in the field of Printed and Hybrid Manufacturing. He has worked in the field of printed and hybrid electronics and its applications since 2001 as researcher, project manager and team leader at VTT. He has been actively working with various globally leading printed electronics technology companies as well as end user companies in contact R&D and joint research projects. His research interests are focused mainly in large area sensing and silicon – printed hybrid solutions.

Technology Advances and New Applications for Flexible Electrophoretic Displays

M. McCreary
Chief Technology Officer
E Ink Corporation, R&D, Billerica, MA, United States

Abstract
Flexible electrophoretic displays (EPD) are now being implemented for a broad variety of new applications beyond the already prevalent electronic reader markets. The characteristics of these latest generations of displays will be described and how characteristics such as low power, bistability, daylight readability, light weight, and bendability characteristics are enabling specific new product applications such as fitness tracker wearables, secondary displays on mobile phones, signage, active furniture, and architecture. Very recent advances in large area flex displays, bright color, and module systems using printed antennas, photovoltaics, and wireless communication of “pixels” will be described along with the opportunity to further integrate printed electronics, thin silicon chips, and alternate thin power sources with these flexible, plastic displays.

Biografie
Michael McCreary is the Chief Technology Officer of E Ink Corporation where he leads a team of scientists in the creation of advanced reflective electronic displays. This innovation has helped enable broad acceptance of daylight readable electronic readers today and is also now being used for fitness wearables, electronic shelf labels, and signage. Dr. McCreary received his Ph.D. in Physical Organic Chemistry from the Massachusetts Institute of Technology, a B.S. in Chemistry from Principia College, and additional training in solid-state physics and electronics at the Rochester Institute of Technology. Prior to joining E Ink in 2000, he was the general manager of the Microelectronics Technology Division at Eastman Kodak that developed high performance solid state image sensors for astronomy, space, industrial inspection and other applications. Dr. McCreary serves on the Advisory Board of FlexTech Alliance, an industry consortium related to the development and application of flexible electronics.

New architectures for OLED Displays: increase lifetime and resolution

M. Hack
VP of Business Development
Universal Display Corporation, Ewing, United States

Abstract
Previously we have presented a novel phosphorescent AMOLED display architecture that enables the fabrication of AMOLED displays using only two low resolution masking steps, and consumes comparable power, and has significantly improved lifetime, as compared to an equivalent RGB side-by-side AMOLED display using three high resolution patterning steps. This architecture can be designed to enable the mask resolution to be only half that of the resultant display in both x and y directions. This new architecture also increases sub-pixel aperture ratios by only requiring one emissive color layer change per pixel, and therefore only one mask tolerance per pixel. The increased fill factors further improve device lifetimes.

Based in part on the architectures discussed above we will also disclose a new pixel layout which allows the user to selectively limit the amount of deep blue content in the display to mitigate the potential health issues associated with deep blue emission.

In this talk we will present further advances on this topic including steps to increase display lifetime and a further modification to this architecture to render very high pixel resolutions necessary for virtual reality (VR) applications.

Biografie
Dr. Michael Hack, is Vice-President of Business Development at Universal Display Corporation. He is responsible for developing and commercializing advanced high efficiency next generation OLED products, with a special focus on flexible display applications and solid-state lighting. Prior to joining UDC in 1999, he was associated with dpiX, a Xerox Company, where he was responsible for manufacturing flat panel displays and digital medical imaging products based on amorphous silicon TFT technology. Dr. Hack received his Ph. D. degree from Cambridge University, England in 1981 and in 2007 Dr. Hack was elected a Fellow of the Society for Information Display. In 2014 Dr. Hack was nominated to serve on the board of the U.S. OLED Lighting Coalition to promote the advancement and commercialization of OLED lighting.

R2R Vacuum Tool Architecture and Process For Next Generation Display Devices

F. Pieralisi
T B A
Applied Materials, OPEN, United States

Abstract

For the realization of next generation Ultra High Definition Televisions (UHD-TVs) both quantum dots (QDs) and organic light emitting diodes (OLEDs) will play a crucial role. Both materials are extremely sensitive to the presence of water vapor, so high grade barrier encapsulation films (down to 10-6 g/m2 day) are mandatory to achieve the 10 years lifetime at room temperature required by commercial products. In this paper the latest advances in R2R CVD processing will be illustrated, showing the impact on optical and barrier performance of substrate type, single layer and fully integrated multilayer CVD based film stacks. Architectural solutions to challenges inherent in moving from lab & pilot scale manufacturing to high volume production will be illustrated. Particular attention will be given to defect detection & mitigation, critical for achieving high production yields and enabling the upcoming wave of flexible electronic devices. Further developments will also be discussed in terms of infrastructure & process development for patterning of micron level features & devices.

Biografie

Dr. Fabio Pieralisi received his degree in Electronic Engineering from La Sapienza University of Rome and his Doctoral Degree in Electrical Engineering from the University of Stuttgart. As a researcher, he worked on LTPS integrated analogue and digital display drivers. After joining Applied Materials, he developed advanced sheet-to-sheet (S2S) PVD processes for UHD displays and chip packaging applications. He currently develops roll-to-roll (R2R) CVD processes for ultra-high (UH) barrier films for QD, OLED and OPV applications. He manages defect reduction activities for large-area vacuum coating equipment.

Hybrid Integration for Plastic Film Electronics

C. Landesberger
Manager Research Group “Thin Silicon”
Fraunhofer EMFT, Munich, Germany

Fraunhofer EMFT

Abstract
Polymer foils are an increasingly attractive substrate for several electronic applications. They are matchless for the fabrication of very thin and highly flexible electronic systems and rather inexpensive substrates for large-area applications. In combination with functional materials like the organic semiconductor and printing technologies there was big hope that electronic systems can be fabricated directly by coating and patterning steps without any assembly steps, a big vision for volume production of integrated systems.

Despite the achievements obtained in this area, especially for photonic systems, there has been a considerable drawback regarding the realization of integrated circuits. Although there has been a lot of success in organic semiconductor research and related demonstration of applications, no realistic approach for a larger scale circuit integration is available that can compete by performance and economically with state-of-the-art silicon ICs.

The difficulties in realization of organic integrated circuits lead to the concept of hybrid integration. In principle hybrid means bringing together the world of large-area coating, patterning and printing with the world of assembly and interconnect of components. On a first view, this is rather similar with the conventional approach of electronics packaging, however there are also large differences related to the plastic film substrate and the specifics of foil electronics. Dimensional instability, shrinkage and wrinkling, low temperature processing, bending and folding reliability play a much more pronounced role in plastic film technology.

The different approaches for hybridisation on plastic films and corresponding challenges are discussed by means of different development examples from several application fields. In detail the impact of above mentioned critical properties are investigated application-oriented for packages of consumer goods.

Biografie
Christof Landesberger received the diploma degree in physics from Ludwig Maximilian University in Munich. He joined Fraunhofer Institute in Munich in 1990 and is now heading the research group “Thin Silicon” within the department “Flexible Systems” at Fraunhofer EMFT. He has been working in the field of ultra-thin silicon since more than 15 years and prepared more than 20 patent applications in the field of handling and processing techniques for ultra-thin semiconductors. His current research topics are focusing on packaging technologies for ultra-thin semiconductor devices, including self-assembly and flexible chip foil packages.

A novel pick-and-place process for ultra-thin chips on flexible smart systems

T. Meissner
Head of Micro Assembly
Hahn-Schickard, Stuttgart, Germany

Abstract

In order to truly make thin flexible systems smart the integration of ultra-thin Si-based chips is essential. This however requires the development of novel processes for the manufacturing and handling of such chips. Much progress has been made towards the reliable thinning of chip-wafers down to thicknesses of 20 µm. Nevertheless, picking the delicate chips from the adhesive foil used for wafer processing plus transportation without damaging and subsequently placing them on substrates remains challenging since conventional approaches for pick-and-place are unsuitable.

Here we present a novel approach that relies on an optimized pick-and-place tool in combination with the use of thermo-release foils. We show that chips as thin as 20 µm can be quickly picked with little strain and hence be subsequently processed reliably.

Biografie

2003 – 2009 study of physics at the University of Leipzig, Germany
2005 – 2006 stay at university of Lancaster, UK
2009 – 2013 doctorate at the University of Leipzig in the field of experimental solid state physics > development of an experimental setup to investigate materials under extreme pressure conditions
2013 – 2015 research scientist at Hahn-Schickard Stuttgart > focus on sensor development for medical applications
Since 2016 head of micro assembly at Hahn-Schickard Stuttgart > focus on development of novel packaging concepts

Injection Molded Electronics: Mass Manufactured Smart Plastics

A. Keränen
CTO
TactoTek, Oulu, Finland

Abstract

TactoTek Injection Molded Electronics (IME) is a solution that integrates printed electronics (circuitry, sensors, and antennas) and discrete electronic components (LEDs, ICs, etc.) inside of 3D plastic structures, thus changing the 100 years old picture of electronics as “components in a box” into 3D smart plastic surfaces.

TactoTek IME integrates building blocks of lighting, sensors and active control electronics to deliver a wide range of functions in high visual quality 2D and 3D plastic structures that are 2-4 mm thick. The TactoTek IME manufacturing process consists of five steps: 1) Print decoration on plastic film, 2) Print wiring, electrodes, antennas and other printable electronics on IML film, 3) Mount standard SMT electronics on film using standard 2D SMT, 4) Thermoform the assembled film into desired 3D form and 5) Use the assembled and formed film as an insert in standard injection molding process. Steps 1, 2, and 3 take place when the structure is 2 dimensional using existing high speed mass manufacturing equipment and processes.

IME solutions reduce space and weight and simplify assembly while creating differentiating design opportunities. Some specific technology benefits worth highlighting include: using the plastic structure itself as a light guide instead of external assemblies, and placing sensors and antennas extremely close to part surface to improve signals and reduce noise.

Biografie

Dr. Antti Keränen is a co-founder and technology leader at TactoTek. He directs R&D innovation activities, develops and maintains the IP portfolio, and communicates the company technology vision and practical applications. Antti has been a major contributor to advancing in-mold electronics technology since 2005, when he joined the VTT Technical Research Center of Finland printed electronics team. In addition to his work at TactoTek, he is an Adjunct Professor of theoretical physics at the University of Oulu where he also earned his PhD.

Micro-Transfer-Printing for Flexible Passive Matrix Displays based on Inorganic LEDs

A.J. Trindade
Research Scientist
X-Celeprint, Limited, Cork, Ireland

Abstract

Inorganic light-emitting diodes (iLEDs) are amongst the longest lived and most energy efficient light-emitters available for an extensive range of applications. Direct-emission displays using these types of light sources have been around as an established technology and are typically known as 'Jumbotron' displays. Recently, there is a growing interest in the miniaturization of such displays where pixels can be tightly packed (>30 per inch) in a multitude of substrates.

To achieve the desired level of scale reduction, disruptive technologies are required to handle miniature wafer-fabricated components in high-density arrays and transfer these onto a new display substrate at high-speed, precision and low cost. Since control circuits, light emitters, sensors are usually sourced from different wafer-based material systems (Si, GaN, InP, GaAs…), this introduces added complications for integration onto display panels. Invented at the University of Illinois with over ten years of continuous development, micro-Transfer-Printing (µTP) effortlessly enables the heterogeneous integration of devices based from disparate material systems onto various substrates. By use of an elastomer stamp to release and transfer the devices arrays onto non-native substrates, µTP has a proven record in iLED displays, magnetic storage, Silicon Photonics, Photovoltaics and compound semiconductor integration. Here we present a display prototype using miniaturized iLEDs as fully functional pixel emitters. Standard transfer yields typically exceed 99.9% and the emitting pixels can be printed by a single print step (total of 3 prints for RGB displays). Due to the reduced emitter size (3x10µm2), displays have a high degree of transparency due to the low fill-factor that emitters and metal tracks occupy on the overall display area.

µTP can therefore be a platform to fully functional rigid or flexible displays with high throughput, efficiency and reliability.

Biografie

Dr. António José Trindade is a Research Scientist at X-Celeprint. António José is an expert in Organic Light Emitting Devices (OLEDs), Organic Photovoltaics (OPVs) and micro-LEDs. He has worked extensively on different architectures and taken multiple devices from concept to fabrication/integration and final assembly onto rigid and flexible substrates.
He has a wide background on several optoelectronic devices as well as transfer-printing technologies and device-level integration. His main interests include heterogeneous integration, device prototyping, novel assembly techniques, light-emitting semiconductors, light propagation and micro-displays.

Continuous monitoring of manufacturing processes dedicated to PE

M. POPOVIC
GENERAL MANAGER
IN-CORE Systèmes, 69800, Saint Priest, France

Abstract
Continuous inspection is the key point to maintain yield targets and to ensure the repetitiveness in printed electronics manufacturing processes. Among the inspection techniques, the real time control based on visual inspection 2D and 3D is the most comprehensive solution. The multipurpose sensors (cameras) with adequate light source are used above all to run properly the process. The positions, overlap, registration of all printed/coated features are controlled with very high resolution. The process defect such as printing, coating defects which have the functionality impact on the elements (circuits, cells, sensors) are detected and localized to be removed in downstream process. This inspection solution offers also a huge flexibility which is essential for the processes which are in permanent modification toward the new ways and standards.
The implementation of visual inspection into printing electronics process flows is demonstrated on two case studies:
• circuit components from printing processes
• organic photovoltaic manufactured in coating process.
Image acquisition conditions are discussed as a function of used substrate and ink properties. It is shown for both examples that it is feasible to highlight crucial defects such as short circuits and circuit breaks, lack and excess of inks and inclusions of foreign particles and thus directly relate optical impact to electrical yield. “

Biografie
Michel POPOVIC received his degree in Electrical Engineering (CUST University, Clermont-Ferrand France) and obtained his Phd Thesis in Electronics in 1993 at "UFR de Recherche Scientifique et Technique"-University Blaise Pascal in Clermont-Ferrand France. From 1988 to 1998, he worked as the R&D project leader at Centralp Automatism (Vénissieux- France) being in charge of the systems architecture development integrating automatic real-time inspection dedicated to industrial applications. In 1998 he co-founded IN-CORE SYSTEMES, an established technology company known in the field of vision inspection whose expertise focuses on designing imaging systems line-scan camera based and providing optical methods for high-valueadded surfaces inspection and measurementS solutions for quality control and process characterization oriented - meant for Printed Electronics applications among many other fields

In-line High Resolution 3D Surface Measurements for Substrate Characterization

E. Novak
Director of Business Development
4D Technology, Tucson, United States

Abstract

As more flexible electronics products enter large-scale production, focus is increasingly moving from simply demonstrating technological capability towards higher yields, longer lifetimes, and superior performance. To improve profitability and market size of offerings, critical features that can affect performance must be monitored, including surface roughness, defect density, defect size and slope. Ideally, in-situ metrology can be employed in roll-to-roll equipment to allow real-time process control of these key parameters. Barrier film permeability, circuit performance, and overall yield may all be better controlled via real-time measurements from within the roll-to-roll processing equipment.

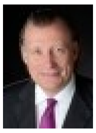
This paper will present a compact, low-cost, large-field 3D metrology module for in-situ measurements of flexible electronic substrates. The module is capable of sub-nanometer vertical resolution and micrometer-scale lateral resolution for accurate roughness and defect height determination. More than 17 cm^2 per minute of surfaces can be measured with 2 um lateral resolution. Modules are very compact, slightly larger than a mobile phone, and can be arrayed to provide scalable areal coverage based on each customer's specific needs. Modules are vacuum compatible, vibration-immune, and are unaffected by the film backside or roller characteristics and thus ideal for placement within coating machines. While primarily designed for metrology of flexible electronics substrates, particularly barrier films, this metrology system also can perform high-speed 3D characterization of glass panels, semiconductor wafers and other smooth surfaces.

This paper will present data from a variety of samples measured these metrology modules, and correlate results with other precision measurement techniques. Flexible substrates will be measured on a roller in a roll-to-roll systems. Additional flat samples will be shown as measured with the metrology modules mounted over an XY stage.

Biografie

Dr. Erik Novak is Director of Business Development at 4D Technology. He has been developing instrumentation for precision metrology for more than 19 years in applications including displays, optical components, plastic films, MEMS, telecommunications, photovoltaics, and medical devices. He received his PhD from the University of Arizona Optical Sciences College in 1998. Erik has received four R&D 100 awards, holds numerous patents, and has more than sixty publications and book chapters related to surface measurement and industrial process control.

Integration of Nano imprint R2R into the production processes for printed electronic products



T. Kolbusch
Vice President
Coatema Coating Machinery GmbH, Dormagen, Germany

Abstract
Integration of Nano imprint R2R into the production processes for printed electronic products

Full abstract will be submited shortly.

Biografie
Curriculum Vitae

Thomas Kolbusch, Coatema Coating Machinery GmbH

Thomas Kolbusch is Vice President of Coatema Coating Machinery GmbH, an equipment manufacturing company for coating and printing solutions located in Dormagen, Germany.
Since 1999 he is working for Coatema Coating Machinery GmbH in different positions. His responsibilities are marketing, sales and business development.
He is member of the board of directors of the OE-A (Organic Electronics Association). In the OE-A he leads a working group which is dedicated to “Up-scaling Production – from Lab to Fab” and is chairman of the Lopec exhibition which is world largest event on printed electronics.
He is member of the board of directors of COPT.NRW which is a local association in Germany on printed electronics.
Since March 2014 he is also in the board of directors of Printocent, an association of VTT Finland, where 35 partners are working on topics in printed electronics.
He is chair of the advisory board of the OPE journal and organizes the Coatema Coating Symposium, an international coating and printing seminar which takes place in Dormagen since 13 years. He has spoken on over 200 conferences worldwide.
He was a member of several European and German funded projects like Diginova, Facess and Flexlas.
Thomas studied Business Economics at the Niederrhein University of Applied Sciences and got his degree as business economist in 1997. He worked for 3M, Germany and the alpi GmbH in Germany, before starting at Coatema GmbH.

L.G. Occhipinti
Principal Research Associate, Outreach and Business Development Manager
University of Cambridge, Department of Engineering, EPSRC Centre for Innovative Manufacturing in Large-Area Electronics, Cambridge, United Kingdom

Biografie
Since April 2014 Dr. Luigi G. Occhipinti is member of the University of Cambridge, Electrical Engineering Division, and National Outreach Manager of the EPSRC Center of Innovative Manufacturing for Large Area Electronics (www.largeareaelectronics.org). He is also Founder and Director of Engineering at Cambridge Innovation Technologies Consulting Limited (www.citc-ltd.co.uk), a start-up company built to innovate the healthcare and medical sector. He has 20 years of experience driving research and innovation in the semiconductor industry,

pioneering the field of post-silicon technologies, including development and applications of: organic and printed electronics, MEMS and bio-MEMS devices, graphene-based flexible electronics, smart sensors and systems heterogeneous integration, chemical and bio-sensors for personalized diagnostics and therapeutics.
Prior to moving to the UK, Luigi was R&D Programs Director and Senior Group Manager at STMicroelectronics (www.st.com), a global semiconductor company, where he was in charge of multidisciplinary research teams and new business development based on Heterogeneous Integrated Smart Systems, Flexible and Disposable Electronics and New Sensors technologies. He has authored and co-authored over 85 scientific publications and 37 patent families (H-index 18).
He is recognized expert in the field of printed, organic and large-area electronics and integrated smart systems, and has been Principal Investigator of multiple EC-funded programs in the areas of Information and Communication Technologies (ICT) and Nanotechnologies, advanced Materials and Production (NMP). Dr. Occhipinti has been member of 2 IEEE (P1620, P1620.1) and 3 IEC standardization technical committees (TC105, TC111, TC113), and served: i) as executive committee member, the Italian District for Polymeric and Nanocomposite materials (IMAST) from 2010 to 2014, ii) as scientific committee and advisory board member, 3 EC-funded European projects in the field of micro and nano-robotics and Organic and Large-Area Electronics, iii) as external expert, assisting the EC in progress review of funded projects in the area of large-area electronics and solid-state lighting, and iv) as non-executive director and scientific committee member, innovative startups in the field of printed electronic materials and energy storage.

The Unique Challenges of Designing Battery Powered Solutions for Flexible Electronics

C. Ho
CEO
Imprint Energy, Inc., Alameda, United States

Abstract
Powering the next generation of flexible electronics with batteries provides a unique subset challenges for battery designers. To enable the field, new materials, manufacturing processes, and characterization methods are needed. Furthermore, as flexible electronic devices become more integrated and compact, batteries become a more prominent focal point in the product design phase. Due to the latest exciting battery innovations, for the first time, product designers can think of batteries as a designable elements. This paradigm shift in product design requires battery designers to interact more directly with product designers to mutually understand what is possible, and what are key limitations. The challenges faced by battery and product designers in the flexible electronics space will be highlighted, and key strategies to overcome these challenges will be discussed. Today's ultrathin and flexible battery solutions will also be reviewed.

Biografie
Dr. Christine Ho is a co-founder and Chief Executive Officer of Imprint Energy, a UC Berkeley spin-off commercializing a revolutionary printed battery technology of which Dr. Ho is the principal inventor. Imprint Energy, based in Alameda, CA, is developing technology to enable long lasting, low cost, rechargeable batteries composed of earth-abundant materials for today's and tomorrow's electronic devices. Dr. Ho received her Ph.D. in Materials Science and Engineering from UC Berkeley.

Lifetime Study of Flexible Encapsulated Organic Photovoltaic Modules: Optimization of Device Architecture and Selection of Encapsulation Materials

S. Berson
Head of laboratory of organic photovoltaic modules
CEA, Le Bourget du Lac, France

Abstract
The lifetime of organic photovoltaic devices is a critical point limiting their marketability. In order to improve it, the devices rely on barrier encapsulation to prevent their oxidation by oxygen and moisture. A common technique is the lamination between two glued gas-barrier films. Water and oxygen ingress occurs as a result of the orthogonal permeation and the lateral permeation. In order to elaborate a suitable protection versus atmosphere, it appears important to be able to assess the complete encapsulation scheme. In this communication, we will describe the tools we have developed to characterize the encapsulation: gas barrier measurements methods allowing a rapid screening of gas barrier properties; and optical calcium test mimicking the real device geometry and allowing to measure the lateral permeation through adhesives and interfaces after lamination.
This overall assessment of the encapsulation scheme helps to choose the material set, the encapsulation process, and the optimal geometry. A straightforward link between encapsulation materials characterization and device lifetime can be made and will be presented.
However, encapsulation cannot account by itself for device lifetime. Further improvements in device lifetime can also be brought by optimization of device architecture. In particular, the interfaces within the device or between glue and device play a major role. We will show the influence of interfaces optimization on device ageing, along with mechanical and opto-electronic characterizations. Peeling tests coupled to physico-chemical characterization of the peeled devices are a powerful method to identify the weakest interfaces within the stack.
As a conclusion, we demonstrate flexible encapsulated organic photovoltaics devices able to reach a T80 of at least 1000 h in damp heat conditions (85°C 85% RH) and after 200 thermal cycles (-40°C +85°C). Outdoor ageing were also tested.

Biografie
Dr Solenn Berson (F) graduated from CPE Lyon, France (Lyon school of Chemistry, Physics and Electronics) with a master degree in Polymer Materials and Composites in 2004. She got her PhD degree in organic photovoltaic field at the Laboratory of Molecular, Organic and Hybrid Electronics, CEA Grenoble, France. After an industrial postdoctoral fellowship at the LIPHT in Strasbourg, she joined the Organic Photovoltaic group, CEA, INES, Le Bourget du Lac, France in 2008 as a postdoctoral researcher and since 2010 as a project manager for architectures and processes of organic/hybrid photovoltaic devices. Since 2013 she is managing the OPV group and since 2014, she is the Head of the Organic Photovoltaic Modules Laboratory.

Electrode and Electrolyte Ink Development for Printed Batteries

M. Durstock
Chief, Soft Matter Materials
Air Force Research Lab, Materials & Manufacturing Directorate, Wright-Patterson Ar Force Base, United States

Abstract
Printable energy storage facilitates innovation in the manufacture of flexible electronics in that it will enable direct integration of a power source into a device during the fabrication process. To enable such advancement, we demonstrate a universal approach to develop free-standing and flexible electrodes for printable, high-performance Li-ion batteries. This simple approach utilizes a well-dispersed and directly castable mixture of active material, carbon nanofibers, and polymer to make printable electrode inks. The unique composite properties are mainly attributed to the formation of a 3D nanofiber network that acts as the conductive additive, embedded charge collector, and porous, structural scaffold to facilitate Li^+ diffusion. Free-standing electrodes of three common Li-ion battery active materials ($Li_4Ti_5O_{12}$, $LiFePO_4$, $LiCoO_2$) are prepared, each showing excellent cyclability and rate capability. To complement this component, we demonstrate a dry phase inversion technique representing a step toward controlled, printed porosity in Li-ion battery electrolytes. Our approach utilizes a solvent/weak non-solvent system to generate porosity within a polymer matrix and a ceramic Al_2O_3 filler to fine tune the pore size distribution to impart desirable tortuosity within the membrane. These electrolytes offer electrochemical performance on par with commercial separator films even at current rates as high as 5C, with better thermal stability and electrolyte wetting. This material can also be printed directly over an electrode layer without sacrificing performance in either layer. Additionally, the phase inversion process is applicable to composite electrode inks, yielding electrodes with increased electrochemical properties and better flexibility over those prepared with good solvent alone. This technology for both electrolyte and electrode inks is an enabling step toward direct integration of flexible power in confined areas or on non-planar device surfaces.

Biografie
Dr. Michael F. Durstock currently works in the Materials and Manufacturing Directorate of the Air Force Research Laboratory. He is the Chief of the Soft Matter Materials Branch and his research focuses on flexible hybrid electronic materials and devices. He leads research activities focused on materials and process development for energy harvesting and storage systems, flexible and printed hybrid electronics, and integrated device concepts. He is responsible for the coordination of and advocacy for the in-house research portfolio and external development programs. Specific areas of interest include next-generation energy harvesting technologies with a focus on lightweight and flexible devices, nanostructured materials for high performance batteries, nanodielectrics for capacitors, direct write and other printing approaches for integrated device concepts, and flexible/stretchable electronics.

Dr. Durstock received his Bachelor of Science degree in the field of Materials Science and Engineering from the University of Cincinnati, Summa Cum Laude. He obtained his Ph.D. from the Massachusetts Institute of Technology (MIT) as a National Science Foundation Fellow in the field of Electronic Materials within the Materials Science and Engineering Department. While there he examined self-assembly techniques, organic light-emitting diodes, and the dielectric properties of thin polymer films. Prior to joining the Air Force Research Lab, Dr. Durstock worked for the Dow Chemical Company performing a variety of different functions including work at the Ceramics & Advanced Materials Research Group, the Latex Technology Center, Engineering Thermoplastics, and the Analytical Lab. In addition, he worked in the research division of NKK Corporation in Kawasaki, Japan, performing polymer synthesis.

Organic photovoltaic (OPV) modules for the empower of autonomous indoor sensors

N. Lemaitre
R&D Scentist
CEA, LITEN, Department of Solar Technologies, Le Bourget du Lac, France

Abstract

The Internet of Things (IoT) is the network of physical objects—devices, vehicles, buildings and other items—embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data. The number of applications in the fields of industrial and environmental monitoring, energy management, building and home automation is growing exponentially. The powering of all these objects is then a major concern, their autonomy is a requirement. The solutions to get these objects autonomous is closely linked to the energy harvesting from the surroundings.
Organic photovoltaic (OPV) is one of this energy harvesting technology from light. This emerging technology offers numerous advantages, beginning with the ability to produce lightweight, flexible and coloured modules with an incomparable ease of processing. This technology with more than 10% efficiency and several years of lifetime is mature enough to be integrated into objects. Moreover, the possibility to use digital techniques (laser patterning, inkjet printing) allows the customization of OPV modules to the desired design for a successful integration. Their good module ratio at low light makes them good candidate for indoor applications.
In the present work, we will present the results we obtained on inverted OPV modules with more than 5% efficiency, their behavior under low light conditions and different indoor light sources (white LED, fluo). We will demonstrate the ability of this technology to give the autonomy of indoor home automation sensors.

Biografie

Noëlla Lemaître graduated in chemistry engineering from “Ecole Supérieure de Chimie Organique et Minérale” (Cergy-Pontoise) and received her Ph.D. in physical chemistry of polymer in 2001. During her Ph.D., she worked in ONERA on liquid crystal molecules and polymers for non linear optics. After two post-doctorial positions, she joined in 2003 the “Laboratoire Cellules et Composants” of CEA Saclay, where she worked on organic electroluminescent devices for full color devices or lighting. In 2006, she joined the “Laboratory of Organic Photovoltaic Modules” of INES (Institut National de l’Energie Solaire of CEA Grenoble) and deals with the development of bulk heterojunction organic photovoltaic solar cells.

J. Kreis
Director Business Development
AIXTRON SE, Aachen, Germany

J. Kreis
Director Business Development
AIXTRON SE, Aachen, Germany

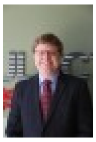
AIXTRON

Biography

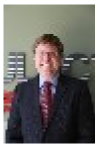
Having obtained his master degree in electrical engineering from University of Karlsruhe in 1993 Juergen held several executive positions in international companies serving the flat panel display and electronics industry for optical systems, metrology, automation, and other capital goods. Juergen holds a second master degree in economics.

In 2010 he joined AIXTRON SE, a leading supplier of MOCVD equipment. In his capacity as Director Business Development is he responsible for Sales and Marketing of AIXTRON’s products related to the manufacturing of organic electronic devices. He has produced several publications and papers about characterization of electro-optical devices, design of optical components, numerical optimization of displays, process automation, gas phase processes et al.

Flexible, Stretchable and Conformable Hybrid Electronics: Substrates and process considerations for building intelligent devices



J. Marsh
Director of Technology
NextFlex, USA, United States



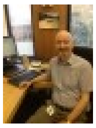
Abstract

Speaker will provide a forward looking vision for how flexible, stretchable and conformable electronics can change the way we live by putting intelligent devices in places they have never existed before in ways that do not interfere with our comfort or daily lives. The focus will include novel substrate materials needed to enable these form factors, including flexible materials, textiles, thermos-formable materials and non-planar structures. Characterization of the challenges ahead will be highlighted alongside several of the creative processing approaches being developed today to realize the NextFlex vision.

Biografie

Jason Marsh is the director of technology at NextFlex – America's Flexible Hybrid Electronics Manufacturing Institute. Jason has worked in operations and engineering roles for Kyocera in the US, Japan, India, Germany, Mexico, Malaysia and China. As a materials science and automation engineer with a focus on machine vision, Jason has worked on a variety of technologies from satellite applications to factory automation. He has served on advisory boards and consulted for companies in a wide range of industries from artificial intelligence to outdoor equipment to solar power to agriculture. He is passionate about seeing manufacturing companies thrive and is focused on the requirements needed to keep US-based manufacturing operations differentiated and globally competitive.

Polyester Films for the Next Generation of Flexible Electronics



B. MacDonald
Business Research Associate
DuPont Teijin Films, Technology, Redcar, United Kingdom

Abstract
Recent Flexible Electronics advances have required material suppliers to deliver improved functionality to the device developers in broad applications such as electrophoretic displays, TFT backplanes, barrier films, photovoltaics, medical diagnostics, and sensors. The next generation of flexible electronics may require a different set of material specifications to enable flexible hybrid systems, foldable displays, and wearable devices.

DuPont Teijin Films has supported this industry from the start with commercially available polyester film solutions that are both innovative and cost effective. These bi-axially oriented, semi-crystalline films provide the end users a unique combination of high stiffness, dimensional stability, optical transparency, solvent resistance, and low cost as compared to several other polymer film types. Demands on polyester film suppliers now typically include: smooth surfaces with low surface defects, low haze, near zero thermal shrinkage, low iridescence, UV stability, and the ability to tailor the surface chemistry to meet the end user’s requirements.
This presentation will include an update on the latest clear, hazy, and white PET (polyethylene terephthalate) and PEN (polyethylene naphthalate) polyester film developments, while discussing the likely requirements and issues associated with meeting the film requirements for emerging applications. Past, present, and future PET / PEN polyester films can provide a balance of cost, processing temperature, and performance that enable cost effective solutions to the OEMs.

Biografie
Bill MacDonald graduated B.Sc and Ph.D in chemistry from the University of St Andrew. He is a Business Research Associate in DuPont Teijin Films (DTF), a 50:50 joint venture between DuPont and Teijin. He is currently actively involved in developing substrates for flexible electronic and PV applications and in understanding the material requirements required for these emerging industries. He has coauthored over 40 papers, several book chapters and regularly presents on the flexible electronic and PV conference “circuit”. He is a Visiting Professor in the Department of Pure and Applied Chemistry, University of Strathclyde.

Constraints and possibilities for direct printing of stretchable electronics on thermoplastic polyurethanes

E. Rubingh
Project manager
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Abstract

Stretchable electronics have gained much interest in the industrial and academic world. Recent developments provide routes to integrate stretchable electronics on textiles and thermoplastic materials allowing applications in fabric and clothing (comfort electronics), formable plastics (formable electronics, 3D printing) and medical applications (skin patches, artificial muscles).
The unique properties of thermoplastic polyurethanes (TPU), such as stretch- and ability to be laminated onto textiles will be shown and complemented by the unique stress/strain characteristics of the polymer.
The talk explains constraints for direct printing of stretchable electronic pastes on TPU. Various stretchable pastes applied by screen printing of conductive structures in a flat-bed setup will be presented and our approach in compensating intrinsic shrink, strain-hardening and re-orientation of the polymeric chains upon printing will be discussed. Constraints are complemented by mechanical and electrical characterization will be provided, resulting in a stretchable electronics measurement protocol, including electrical properties under strain, conductivity loss upon stretching, cyclic tests, lamination and washability.
The talk will be complemented by presenting the latest stretchable electronics demonstrators that are created at the Holst Centre.

Biografie

Eric Rubingh graduated from the Technical College in Eindhoven in Applied Physics in 1997. After two years working with ultra-high powered lasers at Eldim, he joined Philips Research Laboratories in 1999. Next to working on developing the Blu-ray technology he has been the project leader of the team for the inkjet printing of the PolyLED television demonstrator for the SID 2004. In 2007 he joined the Holst Centre as a scientific specialist on printing technologies, developing both S2S and R2R compatible printing processes for functional structures for applications such as OLED lighting, OPV, Smart Packaging and Wearables.

SMART STEEL - PRINTED ELECTRONIC DEVICES ON METAL

P. Guaino
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Abstract
Flexible electronic become an integrate part of the internet of Things (IoT), by making smart system displays, sensors and active functional surfaces. Most of these printed devices are currently integrated on plastic foils, papers, and more recently on thin glass “foils”.
Nevertheless, metallic foil appears to be a promising alternative for several raisons. First, metal can overcome important arising technological difficulties due to the shortcomings durability, moisture barrier properties (particularly for organic material) and heat dissipation. Moreover, metal will allow very original smart applications in Building, Appliance and Automotive. It makes possible a future generation of printed and low cost electronic devices in the metallurgy world.
CRM group (previoulsy ArcelorMittal Research Laboratory) has developed a new advanced steel substrate dedicated to organic and more generally to flexible or conformable electronic devices. Metal will be flexible, rigid, or even formable devices. It will have very good oxygen and water barrier properties if properly used. It is an electrical and thermal conductor, which can greatly improve the lifetime of the device thanks to heat dissipation. Indeed, such substrates can be very helpful for integrated system in “extreme” environment (pressure, temperature conditions and so on). Moreover, smart steel systems can be manufactured in a roll to roll process, which is the key of a low cost, competitive process and compatible with flexible electronic manufacturing.
During this presentation, smartsteel (/metal) applications will be outlined, dedicated to large area device integration. Special focus will be addressed on steel surface treatment to reach exigent physical properties (roughness, planarization, dielectric and conductive materials…) and low cost manufacturing process. At last, example of smart steel products will be presented, based on “printed circuit board “ and interconnected Back/Front side metal foils devices.

Biografie
Philippe Guaino studied solid-state physics at the Faculty of “Sciences and Techniques” at Saint-Jérôme University, Marseille. In 2001, he obtained his PhD thesis. From 2001 to 2006, he was a post-doc researcher in surface science at ‘National Center for Sensor Research’ in Dublin, Ireland, and other micro- and nano-electronic institutes , in France. Since 2006, he has obtained a permanent position at ArcelorMittal research center, now CRM group, in Belgium. He is responsible of the smart coating activities and printing electronic processes on steel