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Printed Electronics World Articles

Paper Electronics

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The largest event in the world on the subject Printed Electronics USA 2010 will once again have a growing minority of presentations on paper electronics. This is the printing of electronics and electrics on or in paper. It is not to be confused with "electronic paper" which is invariably plastic but replaces conventional printing on paper.

Indeed, today, most printed electronics takes place on high grade polyester film because most of the processes require very clean, flat surfaces. However, a high proportion of the products targeted are currently made of paper from magazines and healthcare disposables to packaging and posters.

Printed Electronics USA has major users of printed paper such as JC Decaux in billboards, etc, MWV Packaging and Crayola in children's drawing equipment and toys saying what they need and what they are doing so far.

Smart packaging

Relevant work on printed sensors for smart packaging that is taking place at the University of California at Berkeley will be presented as will the printed electronic paper cards and packaging of Printechnologics in Germany. Information Mediary Corporation of Canada, famous for its compliance monitoring blisterpacks for medicine that use paper and plastic, announces new printed electronics for smart packaging.

Cubic and Kovio will cover printed electronics on plastic film that is then embedded in paper tickets and Isiqiri Interface Technologies of Germany covers large area photosensors for man-machine interfaces. Indeed, Dublin City University in Ireland presents on electrochemical and bio sensors in smart systems.

Bayer of Germany covers its electroactive polymer haptic touch keyboards made with flexible printed electrodes. These can be embedded in paper products, high performance conformal electronics being covered by MC10 Inc.

Commercial products

There is an increasing interest in printing electronics on and in paper and commercial products have appeared such as the millions of paper gaming cards that interface with computers and mobile phones and the disposable electric skin patches that send in cosmetics using a printed paper battery and electrodes.

Intrinsiq and Novacentrix can now print copper patterns on paper with a considerable potential saving in cost over silver for antennas, electrodes, sensors, switches, keyboards, conductors and metamaterials.

The University of Helsinki has developed its own versions. Previously, printed copper would oxidise and become insulating and useless. Printed copper has a huge future but it will not replace all silver because it is not allowed in contact with food in marketed products, it can become electrochemically active and it poisons OLED displays for example.

In the laboratory

In the laboratory, much more is coming along. Electrochemical transistors have been printed onto paper by ACREO in Sweden and others and paper electronics, including transistors, is being researched by Abo Akademi in Finland and The University of Helsinki in Finland. Disposable medical testers made of paper with printed sensors and conductors are about to be launched.

Biopolymers such as paper offer the possibility of creating electronics at very low costs that may even be biodegradable. On the other hand, the Swedish Royal Institute of Technology in Stockholm, Sweden has "cellulose nanopaper" that is stronger than cast iron that will be useful for long life, durable printed electronics.

Transistors, RFID and displays

Organic inks forming unusually flexible and conformal patterns are useful for printing on paper but, because of the challenging topology, the resulting transistors still have limited performance. Indeed, some take several seconds to switch. Polyera will present on printed light emitting transistors based on multistacking structures, a typical component that may first appear on plastic film then later on paper.

Professor Margit Harting of the University of Cape Town in South Africa will describe crushed silicon diodes, thermistors and potentially transistors printed at very low cost onto paper. Nanogram describes printing of nanosilicon devices.

In Portugal, an elegant new zinc oxide field effect transistor with the paper substrate doubling as the gate dielectric layer has been developed by the New University of Lisbon. Remarkably, it has one hundred times the switching speed of amorphous silicon and organic transistors.

Electronic paper is not all about cost reduction. Indeed, Kimberley Clark licenses its carbon impregnated paper process that can involve patterning to form heaters and they could activate electrothermic displays printed on top.

The printed organic transistor RFID being developed by Sunchon University in Korea will be presented at the conference. Initially it involves plastic film substrates but one can see it being applied to paper later as there is no high temperature annealing stage required. South West NanoTechnologies covers novel carbon nanotube technology that enables high volume, low cost printing. The cost of carbon nanotubes is no longer a market constraint.

Batteries

Printed paper batteries from several manufacturers have been successful for some time. A new development here is large scale applications even including grid level power storage being developed by the Paper Battery Company Inc. which will present at Printed Electronics USA. Another development to be presented at this event comes from Uppsala University in Sweden in the form of a salt and paper battery involving low cost, environmental materials throughout.

Memory

De Montfort University in the UK has shown how gold nanoparticles and small organic molecules can be combined to provide non volatile memory in paper. Flexibility is a key benefit here and applications are envisaged in medicine packs that prompt when a new prescription is needed, and roll up computer screens.

Product integrators needed

The benefits of printed electronics particularly shine through when many components are printed on one, preferably flexible, substrate. That is happening with plastic film substrates printed reel to reel by companies such as Soligie and GSI. They are somewhat like silicon fabs in having a considerable repertoire of component printing capability and making complete products to the customer's designs.

Not so with printed paper electronics where most developers have only one component they can print, and no one offers a product integration service based on a wide repertoire of components. This is an opportunity for new entrants.

Printed Electronics USA has visits to centers of excellence, masterclasses, an exhibition, the conference from 1-2 December, an awards dinner and a co-located thin film photovoltaics event.

For more attend: Printed Electronics USA 2010

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