2011 International Conference on Solid State Devices and Materials / 2011 International School on Tokai Region Nanotechnology Manufacturing Cluster

=Workshop (2)=

Recent Advancement in Printed Organic Electronics

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Organizers

H. Usui (Tokyo Univ. of Agri. & Tech.)/ T. Someya (Univ. Tokyo)

Rapid progress in organic electronics has been achieved in recent years, leading to promising results in the field of organic light emitting diodes (OLEDs) and organic field effect transistors (OFETs). Instead of replacing the conventional inorganic semiconductors, the final goal of organic electronics is considered to realize printed electronics, which can bring about innovative breakthrough in cost effectiveness, large scale, as well as flexibility. Although the roll-to-roll printed organic electronics have some way to come into the market, there has been steady progress in this area in recent years. This workshop reviews the current status and perspective of printed organic electronics especially in viewpoint of processing and application technologies.

Speakers

13:00 Prof. Takao Someya , The University of Tokyo

"Introductory talk and overview of printed organic electronics"

In this talk, I will describe recent progress and future prospects of printed electronics. In particular, I will first describe technology trends of inks and printing processes, and then overview recent progress of printed thin-film transistors including organic transistors, and other printed active devices. The issues and the future prospect of printed electronics will be addressed from the view point of output concepts.

13:45 Dr. Toshihide Kamata, National Institute of Advanced Industrial Science and Technology

"Low-temperature / high resolution printing techniques for flexible TFT devices"

In order to develop a flexible TFT device for practical use, development of fabrication techniques to give high performance, high resolution, high uniformity, and high processability to the device is required. In this talk, newly developed advanced print techniques for fabrication of TFT devices on a flexible substrate using printable organic materials will be introduced. Especially, we will mention about how to improve the TFT device performance, and how to remove the process damages using low temperature and high resolution printing techniques for preparation of electrodes, dielectrics and active layers of TFT devices. We will introduce that alternative energy of thermal energy for the device fabrication, such as photon energy and mechanical energy, is quite effective to improve the processability of these flexible devices fabrication.

14:30 Dr. Manabu Ito, Display Research Laboratory, Technical Research Institute, Toppan Printing Co., Ltd.

“Flexible TFT Array by Printing Method”

There has been a significant research investment in the development of a flexible display technology in recent years. Paper-like flexible display adds value to its product due to its rugged-form, lightness and thinness. In order to realize flexible display, printing method attracts tremendous attention. Printing process can enjoy not only low cost vacuum-free production method, but also direct patterning process which can eliminate high cost photo-lithography process. Here, we demonstrate our fully printed flexible TFT array using our proprietary fine resolution printing method. Fine resolution electronic paper of 150ppi was successfully driven by fully printed organic TFT array without any photo-assisted process, which exploits the advantage of printing method. Recently, solution processed amorphous oxide TFT attracts much attention. Compared with other printable semiconductor materials, amorphous oxide TFT can offer large area processability, high mobility, high stability and transparency. Recent progress of solution processed oxide semiconductor will be reviewed in detail. Moreover, we will demonstrate electronic paper driven by solution processed oxide TFT array.

15:15 Break

15:30 Dr. Mao Katsuhara, Display Device Development Division, Sony Corporation

“A rollable OLED display driven by OTFT”

We have developed an 80-□m-thick, rollable AM-OLED display. The display is driven by an organic TFT (OTFT) backplane based on a peri-xanthenoxanthene (PXX) derivative. A flexible gate driver circuit has been successfully integrated using the PXX-based OTFT. The OTFTs have relatively high mobility of 0.4cm^2/Vs and maintain their initial properties even after a 100,000 times bending with a radius of 3 mm.

16:15 Dr. Hiroki Maeda, Research & Development Center, Dai Nippon Printing Co., Ltd.

“Printed electronics for large area flexible device”

There are many trial and progress with printed electronics in display application area, e.g OLEDs and EPDs.Other than these application, large-area devices such as flexible sensor sheet is one of the attractive way of use. Such devices would be utilized in the network infrastructure as human interface by sensing pressure, temperature etc.

Relatively low to mid density of circuit array is appropriate to build these flexible devices. In this sense, printing process is especially suitable for fabrication method. Current status and issue of development would be approached in this talk.

17:00 Prof. Gyou Jin Cho, Sunchon National University

“Roll-to-Roll Gravure Printing Process for Penny RFID Tags”

A ubiquitous low-cost tag society will be fully realized when people can track all items with a radio frequency identification (RFID) system instead of the current barcode system. That means all goods need to have their own RFID tags. To place RFID tags on all goods, the most important factor is the cost of the tags that optimally less than one cent (0.01$). To dramatically reduce the cost of current RFID tags, a roll-to-roll (R2R) inline printing process to print all the units of a passive RFID tag, such as the antenna and transponder, has been considered as an alternative to the current Si-based technology. During the last decade, developing RFID tags using organic semiconductors with a photolithographic process has been demonstrated, however, there has been no report of production of the RFID tags that had been fully printed and R2R printable. The major reasons for the delay in developing all-printed tags originates from the lack of technology for producing an all-printed plastic rectifier that can provide at least 10 volts DC from 13.56 MHz RFID reader, and an all printed-plastic logic circuits that can generate 96 bit of signals to read a 96 bit RFID tag in a second under the DC power provided from the rectifier. Here I describe a way to achieve this goal using plastic foil substrates, and as a consequence of pursuing the ways, R2R printed 13.56 MHz operated 32 bit RFID tags and RF Logos will be demonstrated.