## TECHNICAL SESSIONS

## June 14, 2013

### 16:40-18:00

### Session 9: Novel Materials & Process I
Session Co-chairs:
Mehul Naik, AMAT
Muhannad Bakir, Georgia Institute of Technology

16:40-17:10

***9-1*** ***INVITED - Interconnects with Single Conjugated Polymers***

Yuji Okawa{1}, Swapan K. Mandal{1},{2}, Marina Makarova{1}, Masakazu Aono{1}
{1}National Institute for Materials Science (NIMS), Japan; {2}Visva-Bharati University, India

<*Abstract*>
In order to fabricate a single-molecule electronic circuit, we have to develop a viable method for wiring each functional molecule. The best way to reduce the width of wires to that of single molecules is to connect the molecules with conductive organic polymers. We found before that a stimulation with the probe tip of a scanning tunneling microscope (STM) could initiate a chain polymerization of diacetylene compound. As a result, we could fabricate a single conjugated polydiacetylene chain at designated positions. Based on these previous studies, here we report a novel method for single molecular interconnects, which we call "chemical soldering." Since the front edge of chain polymerization necessarily has a reactive chemical species, when the chain propagation encounters an adsorbed single functional molecule, a covalent bond is formed spontaneously.

17:10-17:35

***9-2*** ***A 0.9um Pixel Size Image Sensor Realized by Introducing Organic Photoconductive Film Into the BEOL Process***

Shunsuke Isono, Tetsuo Satake, Takashi Hyakushima, Kenji Taki, Ryota Sakaida, Shinji Kishimura, Shuji Hirao, Kotaro Nomura, Naoki Torazawa, Makoto Tsutsue, Tetsuya Ueda
Panasonic Corporation, Japan

<*Abstract*>
A stacked image sensor with a 0.9 um pixel size fabricated by using organic photoconductive film (OPF) was realized. It is the first trial to introduce an active material, that is, an organic semiconductor into the BEOL process. This pixel structure is fabricated by using a standard 45 nm BEOL process. However, after OPF deposition, it is essential to restrict the thermal budget and to avoid oxygen, moisture, and plasma irradiation. By controlling the above conditions, a demonstration of a stacked image sensor with OPF, which has high sensitivity, high saturation charge, and a wide incident light angle, was successfully performed.

17:35-18:00

***9-3*** ***Origin of Large Contact Resistance in Organic Field-Effect Transistors***

Takeo Minari, Chuan Liu
NIMS, Japan

<*Abstract*>
The large contact resistance (RC) in organic field-effect transistors (OFET) is one of the main limitation factors which prevent the reliable operation and further reduction in device dimensions. In this paper, we report dependence of the RC on the gate dielectric materials, which means that the density of charge traps in

access region (from contact to channel) of devices plays a primary role for the large RC rather than energy mismatch between Fermi level of the metal electrode and valence band level of an organic semiconductor. Based on the finding, we fabricated top-gate OFET devices, the structure of which minimizes access region resistance. Very low RC of below 0.1 k$f$Ç cm was successfully achieved in the top-gate OFETs. A field-effect mobility of 8.3 cm2/V s and near zero threshold voltage were obtained in top-gate devices based on dioctylbenzothienobenzothiophene.