Poster Abstracts

Semiconductor Technology for Ultra Large Scale Integrated Circuits and Thin Film Transistors III

An ECI Conference Series

June 26 - July 1, 2011
Hong Kong, China

<u>Conference Chair</u>

Yue Kuo
Texas A&M University, USA

<u>Conference Co-Chair</u>

Gennadi Bersuker
SEMATECH, USA

Engineering Conferences International
32 Broadway, Suite 314 - New York, NY 10004, USA
Phone: 1 - 212 - 514 - 6760, Fax: 1 - 212 - 514 - 6030
www.engconfintl.org – info@engconfintl.org

Low Power 6.0-inch Extended Graphics Array Transmissive Liquid Crystal Display using Crystalline Indium Gallium Zinc Oxide Semiconductor with Variable Frame Frequency

Seiko Amano, Semiconductor Energy Laboratory Co., Ltd.
398 Hase, Atsugi, Kanagawa, 243-0036, Japan
T: +81-046-248-1131, F: +81-046-270-3751, sa0809@sel.co.jp
Hiroyuki Miyake, Takeshi Nishi, Yoshiharu Hirakata, Jun Koyama, Shunpei Yamazaki, Semiconductor Energy Laboratory Co., Ltd.
Kenichi Okazaki, Masayuki Sakakura, Advanced Film Device Inc.

Flat panel displays including thin film transistors (TFTs) of an oxide semiconductor such as indium gallium zinc oxide (IGZO) have attracted attention in recent years. This is because an oxide semiconductor TFT has much higher mobility than an amorphous silicon (a-Si) TFT, which leads to the realization of larger displays with higher definition. Moreover, the oxide semiconductor TFT has much lower off leak current than the a-Si TFT. This time, we have focused on this feature and successfully fabricated a low power 6.0-inch XGA transmissive liquid crystal display (LCD) with integrated scan drivers on a glass substrate. In order to realize low power consumption, the frame frequency is extremely decreased, that is, unnecessary rewriting is not performed at the time of still image display. This method can be applied to displays on which still images are often displayed, for example, displays in cell phones, digital photo frames, and PC monitors. Since an external driver circuit can determine whether an image is a still image or a moving image, this driving is compatible with normal display of moving images.

The interval between rewrite operations in our panel could be extended to about 1 minute (□1/60 fps) at the time of displaying still images. The power consumption of the drivers at the frame frequency of 1/60 fps can be about 1/3600 of that at 60 fps.

With lower frame frequency, burn-in might occur when the same image is displayed for a long time. We confirmed that burn-in is not caused when the same image is displayed at 1/60 Hz for ten minutes.

Formation and Characterization of Rare Earth Metal Silicides

Yongwen Yuan, Tosoh SMD, Inc
3600 Gantz Road, Grove City, Ohio, 43123, USA
T: 614-277-4335, F: 614-875-0031, yongwen.yuan@tosoh.com
Eugene Ivanov, Tosoh SMD Inc

Recently, new semiconductor materials such as high-K and metal gate materials have been developed and applied to manufacture complementary metal-oxide semiconductor (CMOS) integrated circuit (IC) devices of 45 nm or less feature sizes with higher operating speeds and enhanced performance. Such CMOS devices require stable and low resistivity contact materials. Traditional Co-based and Ti-based silicides are typically utilized as contacts for 65 nm and above transistor devices. As a consequence of the unsuitability of Co-based and Ti-based silicides, Ni-based silicides contact technology has been developed for use in fabricating transistors with feature sizes of 45 nm and below. However, the contact resistance of NiSi on n-type Si for NMOS is high due to high Schottky barrier height of ~0.65eV. Rare earth metals have low electric work function and have been used for low Schottky barrier applications. Ytterbium (Yb) silicide has been reported to have low work function and Schottky barrier height [1-2]. It is believed adding Yb to nickel silicide could reduce NMOS work function to reach NMOS band edge. Pure rare earth metals (REM) silicides usually form from the solid state interdiffusion of REM and silicon atoms by furnace or rapid thermal annealing (RTA) the REM-films deposited on silicon substrate. Ni-REM alloy silicides can be formed from annealing the REM films deposited on the silicon substrate through either co-sputtering Ni and REM targets or sputtering a single pre-alloyed Ni-REM target. REM and Ni-REM alloys have shown a great potential to form stable and low resistance silicides for 45 nm and below transistor devices. We studied the silicidation and electrical and microstructural characteristics of Yb, Er, Y, and NiYb films deposited on silicon substrate and annealed at different temperatures. The resistance of rare earth metal silicides was measured using four-point probe. The phase assemblies and micro-compositions of deposit layers and interfaces were characterized using x-ray diffraction, scanning electron microscopy, energy dispersive spectroscopy, and high resolution transmission electron microscopy. Our results indicated the formation, microstructures, and properties of rare earth metal silicides were related to the annealing conditions. Resistivity is increased at a temperature of around 250C and film color change was observed around this temperature. XRD and film reflectivity measurements have been conducted to examine the change at this temperature.

Low Voltage Organic Field-Effect Transistors based on poly(2,5bis(3-alkythiophen-2-yl)-thieno[3,2-b]thiophene) semiconducting polymer

Jinhua Li, Department of Applied Physics,The Hong Kong Polytechnic University
Kowloon, Hong Kong, China
T: (852)64430083, F: (852)23337629, 08902296r@polyu.edu.hk
Feng YAN, Department of Applied Physics,The Hong Kong Polytechnic University

The liquid-crystalline conjugated polymer poly(2,5bis(3-alkythiophen-2-yl)-thieno[3,2-b]thiophene) (BTTTT) currently shows very high hole mobility of beyond 1cm2/Vs, indicating great promise for practical applications. However, for practical application of conventional OFETs, the key challenge is related to the unacceptable high operating voltage (>20V) that lead to the problem of high power consumption. In this work, a high-k dielectric material was employed as gate insulator for the fabrication of the PBTTT OFETs and low operating voltage of PBTTT OFETs below 3.0 V were achieved. The high-k gate insulator showed excellently linear capacitance relationship. The dielectric constant of the dielectric was found to be up to 60 at 300 K at 100Hz. The PBTTT OFETs with the high-k gate dielectric showed very good performances. The high hole mobilities of 0.5cm2/Vs and on/ off current ratio of 106 were achieved. At the same time, the PBTTT OFETs with the high-k gate dielectric indicated very small hysteresis of the transfer curves. The inverters were realized in a simple resistor load configuration and exhibited a good signal gain of 11 at the VDD = -4V and very small hysteresis effect.

High carrier Mobility of P3HT induced by TiO_2 nanorods

Sun Zhenhua, Department of Applied Physics,The Hong Kong Polytechnic University
Hung Hom, Kowloon, Hong Kong, China
T: (852)67461155, F: (852)23337629, szh247000456@yahoo.com.cn
Jinhua Li, Department of Applied Physics,The Hong Kong Polytechnic University
Feng Yan, Department of Applied Physics,The Hong Kong Polytechnic University

Organic semiconductor materials with advantages such as low cost, solution-processability and flexible are studied widely and proposed as a kind of substitute of tradition inorganic semiconductor. Many techniques have been developed to improve the carrier mobility of organic semiconductors, which is the most important figure of merit for these materials. In terms of conjugated polymers, It is easy to understand that mixing some distinctive materials into conjugated polymer may deteriorate the crystallinity and lead to more localized energy states in the semi-crystalline polymer film, which will all induce the degradation of charge carrier mobility in the conjugated polymer. But in our work, we find that with TiO2 nanorod whose surface is modified by pyridine ligand added into P3HT polymer, the field effect mobility of holes in this composite film is double, even triple larger than that of the pristine P3HT film. UV-Vis absorbance spectrums indicate that this improvement can be attributed to the enhancement of crystallinity of P3HT in the composited films induced by the nanorods. Through the comparison of different types of nanoparticles, it is confirmed that the rod-like shape and the surface modifier (pyridine ligand) both play important roles on the crystallinity and hole mobility in P3HT matrix. In addition, we demonstrate the application of this kind of composite film in a phototransistor to test light illumination. Therefore these results are important for optimizing the performance of the organic-inorganic hybrid devices, including organic solar cells and organic thin film transistors.