

Optoelectronics and Semiconductor Group

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Field of study: α -Si or LTPS TFT, Organic TFT, TFT-LCD or TFT-OLED process integration and pixel design

Key words: TFT, OLED

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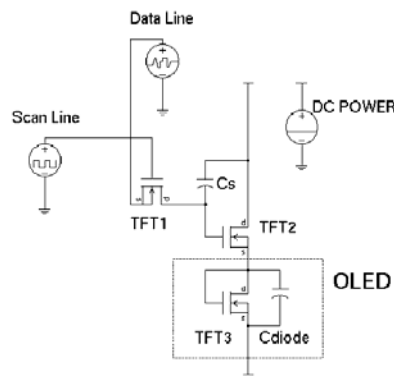
1. The Subject and Aims of Research

- (1) To develop high performance LTPS-TFTs with high uniformity of electrical characteristics
- (2) To develop high performance organic TFTs with high device life-time; Integration OTFT with OLED
- (3) To develop TFT-OLED pixels circuit; TFT integration with OLED

2. Related Recent Research Topics

- (1) TFT-OLED pixels design

We demonstrate the practicability of the ELA poly-Si TFTs fabricated in this project. The devices had been investigated and they were used as active elements in the pixel circuit for a simulation design of a 1.9-inch active-matrix organic light emitting diode displays (AMOLEDs) with a resolution of 120 x 160 x 3 using an H-SPICE circuit simulator. The circuit parameters of the poly-Si TFTs are extracted using the RPI poly-Si TFT model.



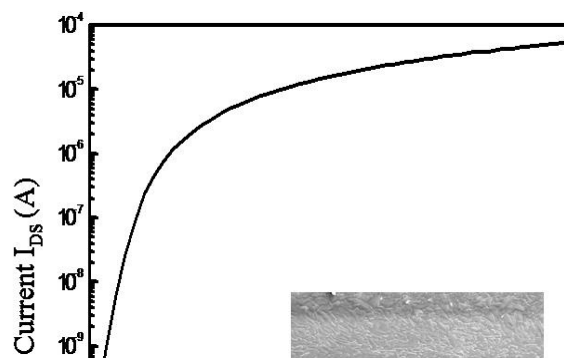
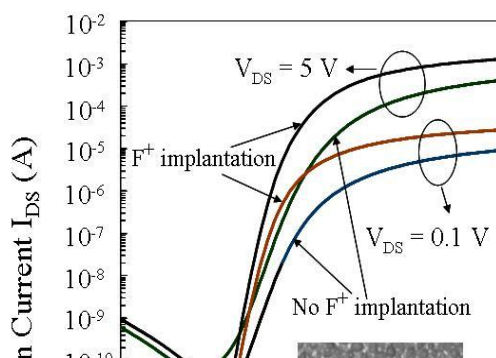
The pixel electrode circuit using two TFTs for 1.9-inch AMOLEDs with a resolution of 120x160x3

- (2) Low-Temperature-Processed Poly-silicon Thin-Film Transistors

We improve the device performance from the issues of the polysilicon crystallization (Excimer Laser, CW-SSLaser, SPC), laser activation, hydrogenation technology and low-temperature-deposition gate oxide to achieve the purpose of integration with OLED. Research results are showed as below.

- (3) Improving OTFT characteristic and life time; Development of OTFT-OLEDs integration technology

We investigate the process integration of organic TFT with high lifetime; Device fabrication on flexible substrate. Finally, we will develop the technology of OTFT driving OLED to fabricate flexible AMOLEDs panel.



3. Selected Publications and Projects

Publications:

1. **Ching-Lin Fan** and Tsung-Hsien Yang, "Effects of NH₃ Plasma Pretreatment before Crystallization on Low-Temperature-Processed Poly-Si Thin-Film Transistors," *J. Electrochem. Soc.*, vol. 153, no.8, pp. H161-H165, 2006.
2. **Ching-Lin Fan**, Cheng-I Lin and Tsung-Hsien Yang, "Low-Temperature-Processed Poly-Si Thin-Film-Transistors With Stable Solid-State Continuous-Wave Laser Crystallization," *Jpn. J. Appl. Phys.*, vol. 45, no. 36, pp. L973-L976, 2006.
3. **Ching-Lin Fan** and Tsung-Hsien Yang, "Effects of Source/Drain Activation on Channel-Length for Excimer-Laser-Crystallized Poly-Si Thin-Film Transistors," *Electrochemical and Solid State Lett.*, vol. 9, no. 2, pp. H8-H11, 2006.
4. **Ching-Lin Fan**, Tsung-Hsien Yang, Yen Chung Chen and Jerry Lin, "Effects of laser activation on device behavior for poly-Si thin-film transistors with different channel lengths," *IEEE Electronics Lett.*, vol. 42, No. 6, 2006.
5. **Ching-Lin Fan**, Hui-Lung Lai, and Tsung-Hsien Yang, "Enhanced crystallization and improved reliability for low-temperature-processed Poly-Si TFTs with NH₃-plasma pretreatment before crystallization," *IEEE Electron Device Lett.*, vol. 27, no. 7, 2006.
6. **Ching-Lin Fan**, Mao-Chieh Chen, and Yi Chang, "A Novel Two-Step Annealing Technique for the Fabrication of High Performance Low Temperature Poly-Si TFTs," *J. Electrochem. Soc.*, vol. 150, no.8, pp. H178-H181, 2003.
7. **Ching-Lin Fan**, Mao-Chieh Chen and Yih Chang, "Low-Temperature -Processed Polycrystalline silicon thin-film transistors Using a New Two-Step Crystallization Technique," *Jpn. J. Appl. Phys.*, vol. 42, pp. 6335-6338, 2003.

Patents:

1. The method of Poly-Si TFT fabrication (No. 20149, Taiwan)
2. Method for manufacturing Poly-Si of thin-film transistor (No. 584964, Taiwan)

Projects:

1. Development of Testing System for TFT-array of AMOLEDs. (NSC95-2622-E-011-010-CC3)
2. Investigation of Plasma Pretreatment on crystallization for Low-Temperature Processed Polysilicon Thin-Film Transistors and its applicators to the Flat-Panel Display. (NSC95-2221-E-011-172)
3. Investigation of Low-Temperature Poly-silicon Thin-Film Transistors with Continuous-Wave Solid-State Laser Crystallization for Active-Matrix Organic Light-Emitting Displays. (NSC 94-2215-E-011 -005)
4. Development and Electrical Investigation of Driving-Current Testing and Panel Aging System for TFT-OLEDs. (NSC 94-2622-E-011 -012 -CC3)

Equipments:

Clean booth (<class 10000) ; Organic Linear-source Thermal Evaporation ; High density Plasma CVD ; Low-leakage manipulator ; Low-leakage probing system ; Glove-box ; semiconductor parameter analyzer