Device

Nano-Rheology Printing Technology for Metal-Oxide Patterns and Devices

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1. Abstract

- A new device printing technology is proposed. This device printing utilizes a viscoelastic transformation of the precursor gel when imprinted; it softens at a certain temperature during thermal-imprinting so that the gel can be rheologically imprinted.
- Excellent metal-oxide patterns were formed by this method. Further, thin-film transistors(TFTs) with channel length around 500nm are easily printed under normal atmosphere.

2. The Nano-Rheology Printing(n-RP) Technology

Process of the Nano-Rheology Printing:

(1) A solution is coated and dried to make a semi-solid thin film.

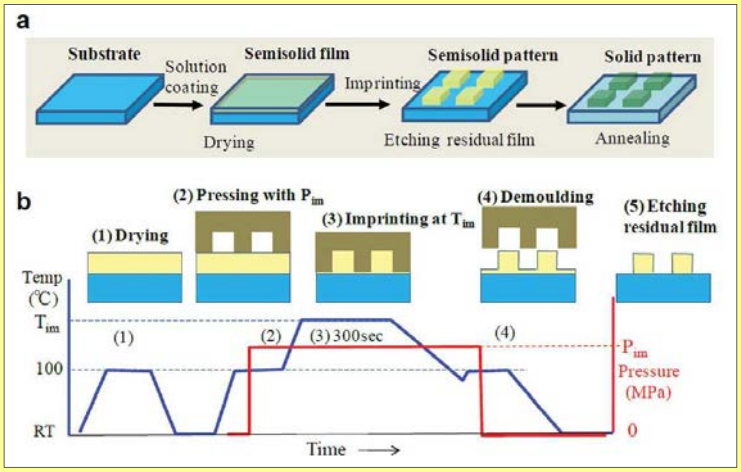
(2) Loaded onto the heating stage of the imprinting machine, after which a mold is set onto the semi-solid film and pressure is applied.

(2)→(3)
When the temperature being increased, the semi-solid film softens at a certain temperature.

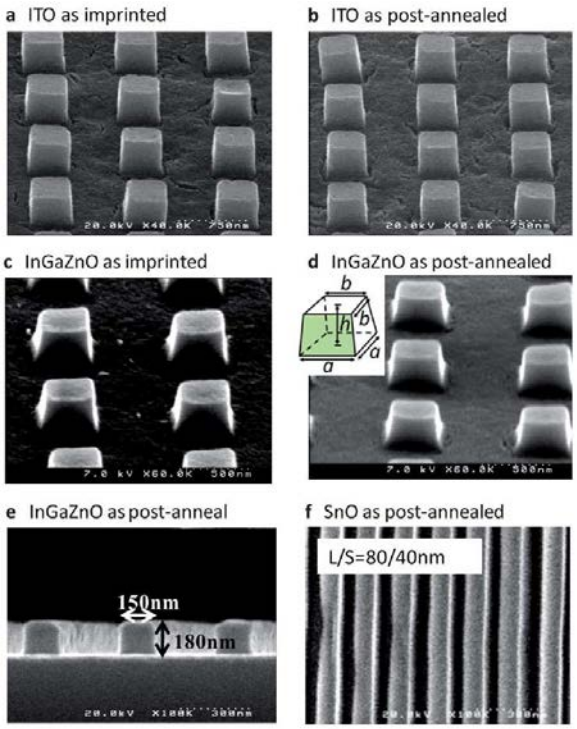
(3) The imprinting temperature(T_{im}) has to be maintained to complete the imprinting.

(4) The temperature being lowered and then the mold is discharged.

(5) The residual film has to be removed by etching in normal atmosphere.

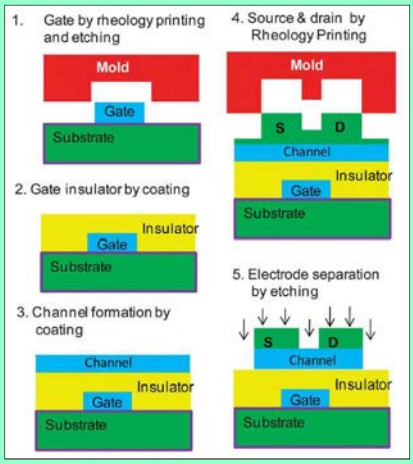


3. Metal-Oxide Patterns Formed by the Nano-Rheology Printing(n-RP) Technology

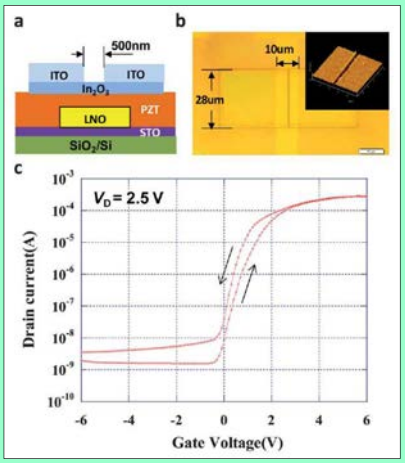


- All samples of formed metal-oxide patterns have a well-defined rectangular shape.
- The deformation after the post-annealing is also slight.

Example of TFT Fabrication by the n-RP Technology



Fabrication Steps of the n-RP



Id-Vg Characteristics of TFT

- The nano-rheology printing technology can fabricate the functional devices, with a short process. These devices can be made by using significantly less raw materials and less energy.
- It is possible to print well-defined patterns of several tens of nanometers necessary for high-performance transistors and circuits.

Patent Licensing Available

Patent : WO2011/138958, WO2013/069686

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