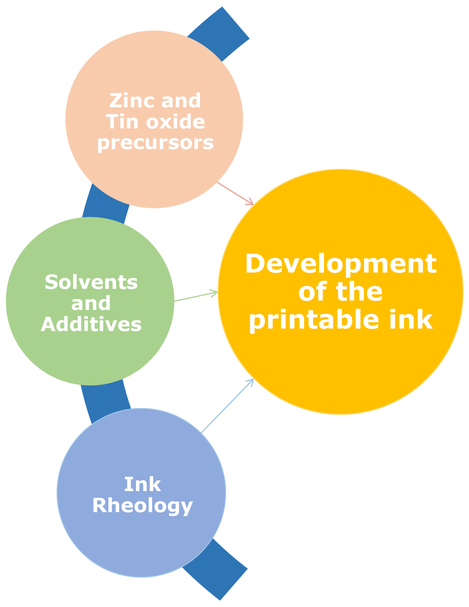
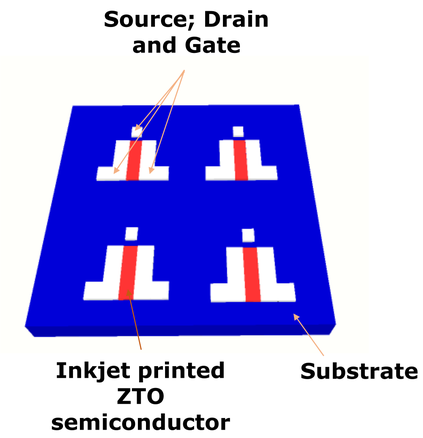
Ink-jet printing of amorphous oxide semiconductors for high performance TFTs



Ink-jet printing process



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Objectives

- ❑ Development of indium free amorphous metal oxide semiconductors produced by solution-processed techniques (ZTO-based semiconductors).
- ❑ Deposition by Spin-coating, Spray-Coating and Inkjet printing techniques.
- ❑ Production of high-performance TFTs with (post-)processing temperature compatible with flexible and low cost substrates such as polymers or paper.
- ❑ Demonstrate circuit integration capability by fabrication of a flexible n-type inverter circuit using ZTO-based TFTs produced by ink-jet.

Methods and techniques

1.Materials synthesis and formulations. Solutions characterization

•Choice of adequate ZTO precursors, adequate solvents and other additives considering the deposition technique

•Characterization of ZTO solution (DSC-TG and Rheology)

2.Deposition and characterization of thin films

•Tuning of deposition parameters for spin- and spray-coating and inkjet printing

•Thin film characterization (SEM, EDS, AFM, XRD, FTIR, PL, TEM, XPS)

3.TFTs and inverters fabrication and characterization

•Shadow masks, optical lithography, simultaneous deposition and patterning (inkjet)

•Static and dynamic electrical measurements, bias and illumination stress

Results

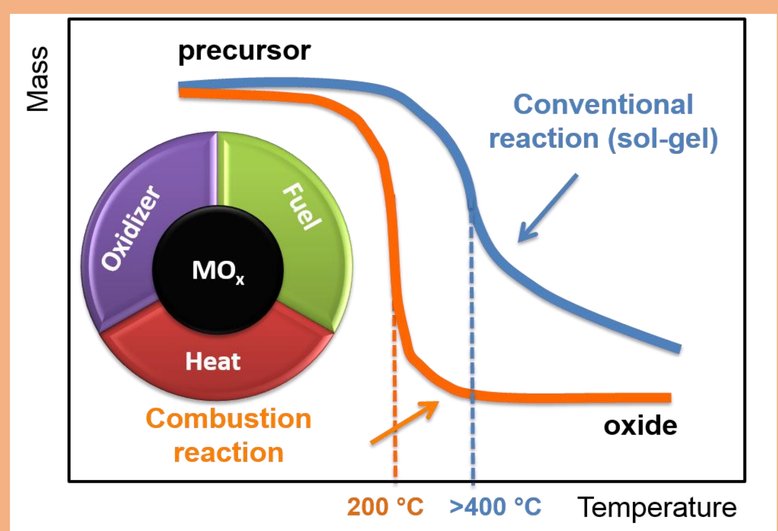
Obtained Results

- Si/SiO_2 and Glass/ITO/ATO substrates were used to deposited ZTO by spin-coating with similar performance as a thin film transistor.
- Reduction of the gate current by optimization of the semiconductor patterning.
- Deposition of ZTO-based amorphous semiconductors at low temperature (T<300 °C) with good uniformity and reproducibility up to 2.5x2.5 cm substrate areas and good stability over time.

Expected Results

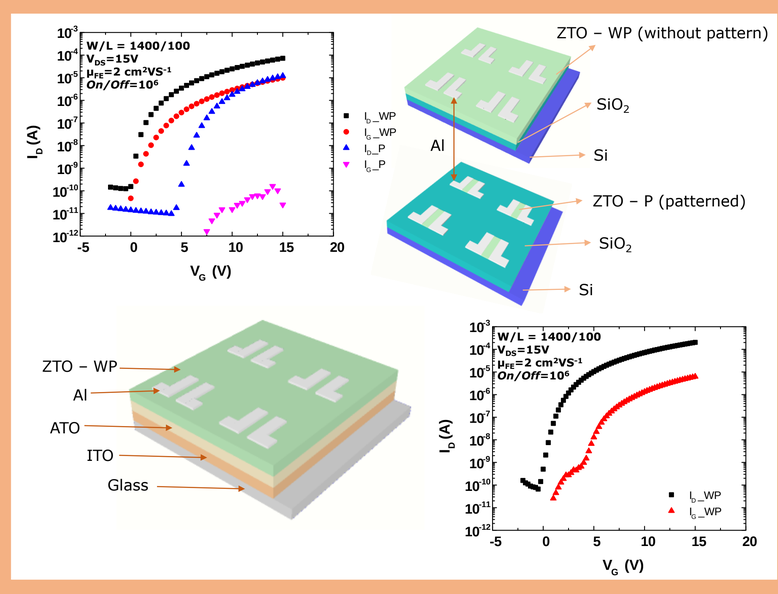
- Solution-processed ZTO-based TFTs with μ>10 cm^2/Vs and ΔV_T<2 V under negative bias illumination stress.
- N-type inverters operating above 10 kHz based on transparent ZTO TFTs produced by inkjet printing on flexible substrates.

Auto-Combustion Reaction



Deposition techniques

Electrical Characterization of TFT



Publications

- Salgueiro, D., Duarte, V., Sousa, C., Alves, M.J., Gil Fortes, A., "Diastereoselectivity in Diels–Alder Cycloadditions of Erythrose Benzylidene-acetal 1,3-Butadienes with Maleimides", Synlett, **2012,** 23, 1765-1768.
- Salgueiro, D., Alves, M.J., Sousa C., Gil Fortes, A., "Diels-Alder Cycloaddition in the Synthesis of 1-Azafagomine, Analogues, and Derivatives as Glycosidase Inhibitors", Mini Reviews in Medicinal Chemistry, **2012**, 12 (14), 1465-1476.

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