

2014 PhD Student in Nanotechnologies and Nanosciences, FCT/UNL  
2011-2013 Research Grant  
2011 Master degree in Medical Chemistry  
2009 Degree in Chemistry  
d.salgueiro@fct.unl.pt



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

CENIMAT|I3N / Materials for Electronics, Optoelectronics and Nanotechnologies Group



## Objectives

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

## Methodology

### 1. Materials synthesis and formulations. Solutions characterization

- Choice of adequate ZTO precursors considering the combustion synthesis route, and 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)

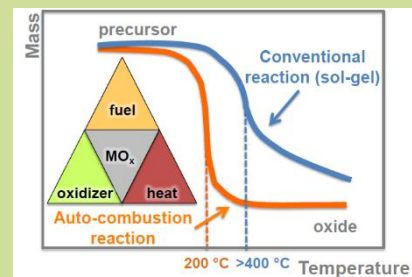
### 3. TFTs and inverters fabrication and characterization

- Shadow masks, optical lithography, simultaneous deposition + patterning (inkjet)
- Static and dynamic electrical measurements, bias and illumination stress

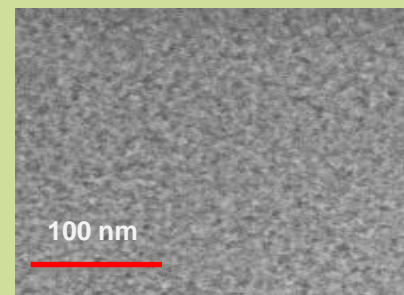
## Expected Results

- ZTO-based amorphous semiconductors produced at low temperature ( $T < 300$  °C), exhibiting good uniformity and reproducibility up to 2.5x2.5 cm substrate areas and good stability over time.
- Solution-processed ZTO-based TFTs with  $\mu > 10$  cm<sup>2</sup>/Vs and  $\Delta V_T < 2$  V under negative bias illumination stress.
- N-type inverters operating above 10 kHz based on transparent ZTO TFTs produced by inkjet on flexible substrates.

### Auto-Combustion Reaction



### Amorphous ZTO Thin Film



### Pixdro - Piezo MEMS DOD



### Electrical Characterization of TFT

