# Optimization of a spray pyrolysis process for the preparation of fluorine doped tin oxide substrates

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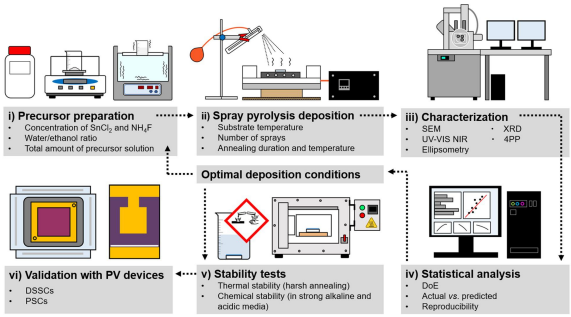
Nanotechnologies

## Introduction

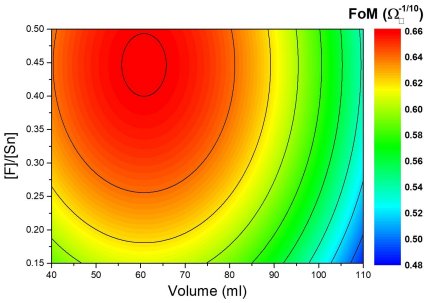
- **Transparent conductive oxides** (TCOs) are used in many applications, namely photovoltaic (PV) devices.
- **Fluorine-doped tin oxide** (FTO) is the most promising alternative to ITO presenting better thermal and chemical stability.
- The main objective of this work was to optimize the deposition of **FTO thin films by spray pyrolysis following a DoE methodology**.



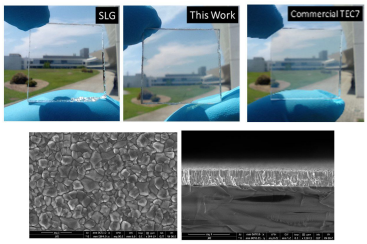

## Optimization of the optoelectronic properties of FTO thin films

- The DoE optimization of FTO depositions on soda-lime glass by spray pyrolysis focused on the two experimental variables that presented the greatest influence in the figure-of-merit (FoM) of the resulting films, *i.e.* the volume of sprayed solution and the [F]/[Sn] ratio in the precursor.

| Experimental variable | Factor | Level -1 | Level 0 | Level 1 |
|---|---|---|---|---|
| V (ml) | $x_1$ | 42 | 54 | 66 |
| [F]/[Sn] | $x_2$ | 0.3 | 0.4 | 0.5 |

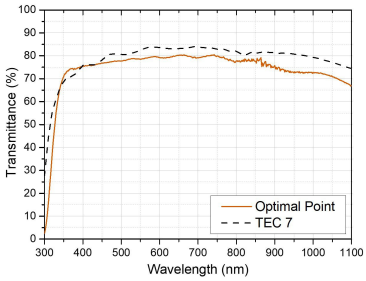



## In-house *vs.* commercial FTO




*Top view and cross section SEM images of in-house FTO.*

## Optical properties




## Conclusions

- FTO-SLG substrates with tailored properties can be prepared by low-cost spray pyrolysis, presenting a high FoM.
- The improved FoM was further assessed with the fabrication of dye-sensitized and perovskite solar cells (DSSCs and PSCs) using commercial and in-house substrates; the efficiency of DSSCs and PSCs was improved by 8.7 % and 4.4 % (relative).

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