UNIVERSITAT JAUME·I

## Lab session 1: Preparation of nanoporous $TiO_2$ films

**Objective**:
Prepare the paste of $TiO_2$ nanocolloids and nanostructured films that will be the base for the next experiences in the study of water splitting, electrochromism, dye solar cells and pollutants degradation

**Material**

| | |
|---|---|
| $TiO_2$ nanoparticles (Degussa P25) | 5-10 mL Pipetes |
| Distilled water | Beaker |
| Ethanol | Magnet |
| Terpineol | Mortar |
| Ethyl cellulose | Ultrasonic Bath |
| FTO Glass | Stirrer |
| Glass bar | Three roller mill |

**Procedure**:

First we will prepare the $TiO_2$ paste from $TiO_2$ nanoparticles from Degussa powder. Then the paste will be deposited on a FTO substrate.

**Paste Preparation:**

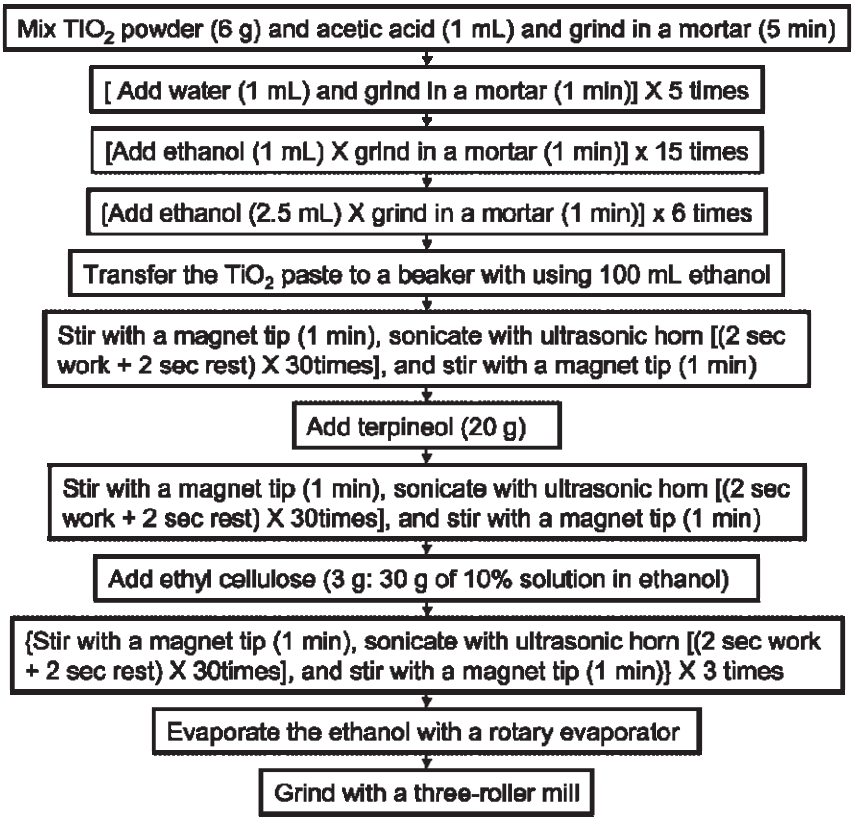


Fig. 1: Esqueme of paste preparation

**Preparation of nanocrystalline-$TiO_2$ electrodes**

To prepare the DSC working electrodes, the FTO glass used as current collector, FTO (TEC-15) needs to be cleaned thoroughly:

- Clean in detergent and water (with hands)
- Sonicate in a detergent solution using an ultrasonic bath for 15 min.
- Rinse with water
- Rinse with ethanol
- Sonicate in ethanol for 10 minutes
- Dry the FTO

Meanwhile, grind the paste by the 3-roller mill.

Doctor blade coating:

- Fix the FTO with scotch tape into a clean surface (the conducting side upwards)
- Deposit some paste in one extreme of the FTO layer
- With a glass rod (blade) extend the paste over the FTO.
- Kept in a clean box for 3 min so that the paste can relax to reduce the surface irregularity
- Dry the film for 6 min at 125ºC.
- Heat the electrodes coated with the $TiO_2$ pastes gradually under an airflow at 325ºC for 5 min, at 375ºC for 5 min, at 450ºC for 15 min and 500ºC for 15 min. Then allow them to cool down slowly. Alternatively, heat the simple in an oven with the same cycle.
- Cut the glass at the desidered size.

**References:**

[1] Ito, S.; Chen, P.; Comte, P.; Nazeeruddin, M. K.; Liska, P.; Péchy, P.; Grätzel, M. Fabrication of screen-printing pastes from TiO2 powders for dye-sensitised solar cells. *Progress in Photovoltaics: Research and Applications* **2007,** *15* (7), 603-612.