

آشنایی با فناوری نانو

بخش اول: مقدمات



ساخت سلول خورشیدی نانو بلوری:

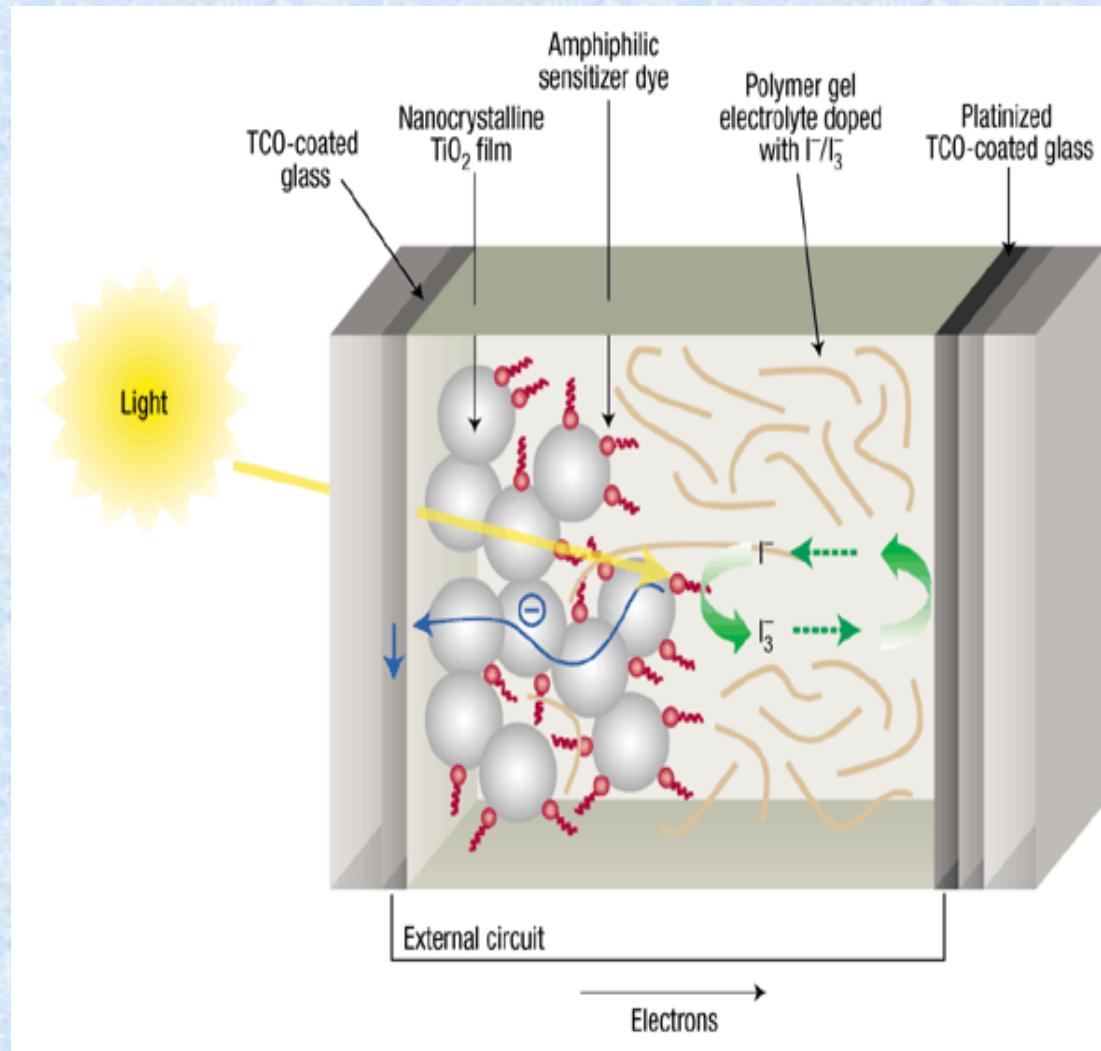


- Ohm's law
- Electrochemistry
- Verification of Kirchhoff's voltage law with cells in series.
- Charging capacitors
- Measuring current and power density
- Measuring internal resistance
- Powering small "no-load" motors

مواد مورد نیاز:

Materials:

1. (2) F-SnO₂ glass slides
2. Iodine and Potassium Iodide
3. Mortar/Pestle
4. Air Gun
5. Surfactant (Triton X 100 or Detergent)
6. Colloidal Titanium Dioxide Powder
7. Nitric Acid
8. Blackberries, raspberries, green citrus leaves etc.
9. Masking Tape
10. Tweezers
11. Filter paper
12. Binder Clips
13. Various glassware
14. Multi-meter



Nanotitanium

1. Add 2-ml of 2,4 – Pentanedione ($C_5H_8O_2$) to 100-ml of anhydrous isopropanol [$(CH_3)_2CHOH$] and stir covered for 20 minutes.
2. Add 6.04-ml of titanium isopropoxide ($Ti[(CH_3)_2CHO]_4$) to the solution and stir for at least 2 hours.
3. Add 2.88-ml of distilled water and stir for another 2 hours.
4. The solution must then age for 12 hours at room temperature.
5. Since you now have a colloidal suspension, the solvent must be evaporated off in an oven to collect the powder.

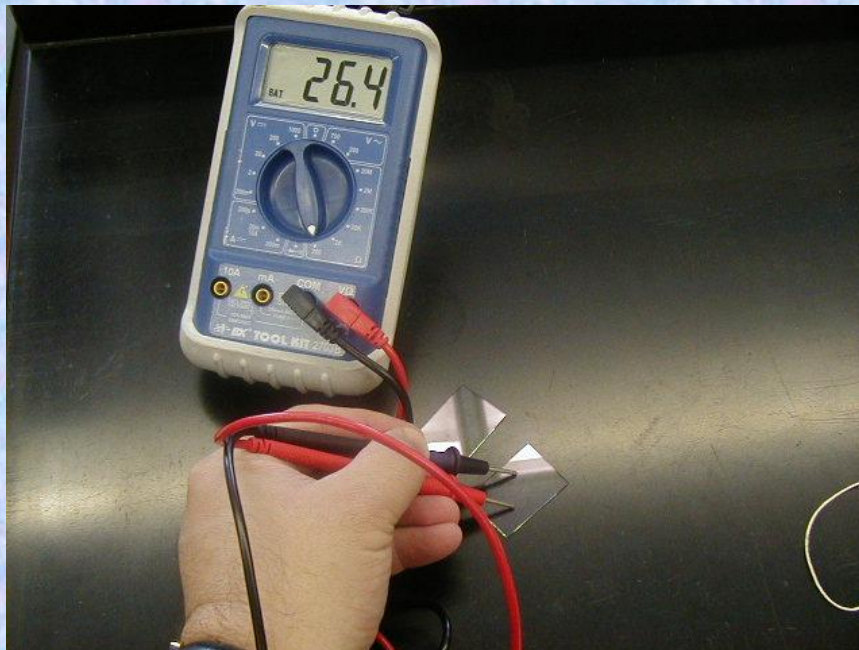
تهيء محلول الكتروليت:

Electrolyte solution

- 1. Measure out 10-ml of ethylene glycol**
- 2. Weigh out 0.127-g of I_2 and add it to the ethylene glycol and stir.**
- 3. Weigh out 0.83 g of KI and add it to the same ethylene glycol.**
- 4. Stir and store in a dark container with a tight lid.**

سلول خورشیدی نانوبلوری

Main component:
Fluorine doped tin
oxide conductive glass
slides



Test the slide with a
multimeter to
determine which side is
conductive

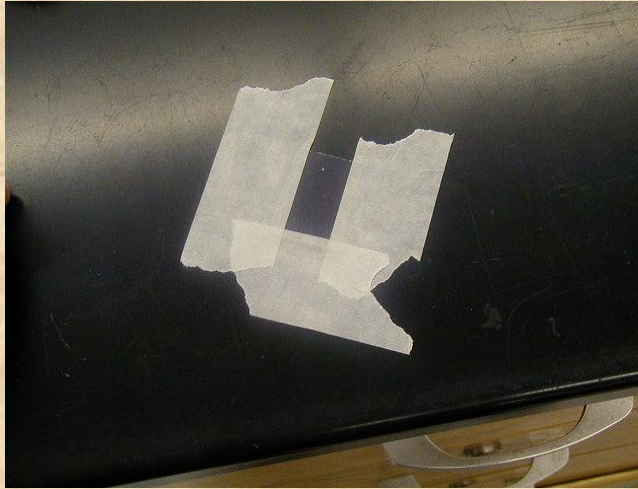
سنتز سوسپانسیونی نانوتیتانیوم

Procedure:

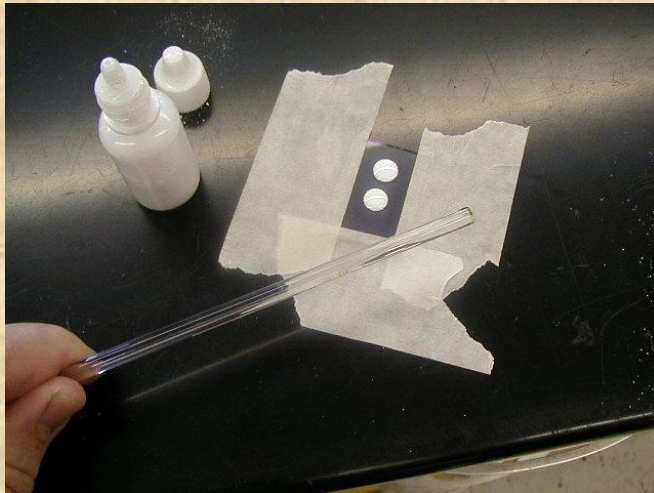
- Add 9 ml (in 1 ml increments) of nitric or acetic acid (ph3-4) to six grams of titanium dioxide in a mortar and pestle.
- Grinding for 30 minutes will produce a lump free paste.
- 1 drop of a surfactant is then added (triton X 100 or dish washing detergent).
- Suspension is then stored and allow to equilibrate for 15 minutes



ایجاد پوشش روی سلول



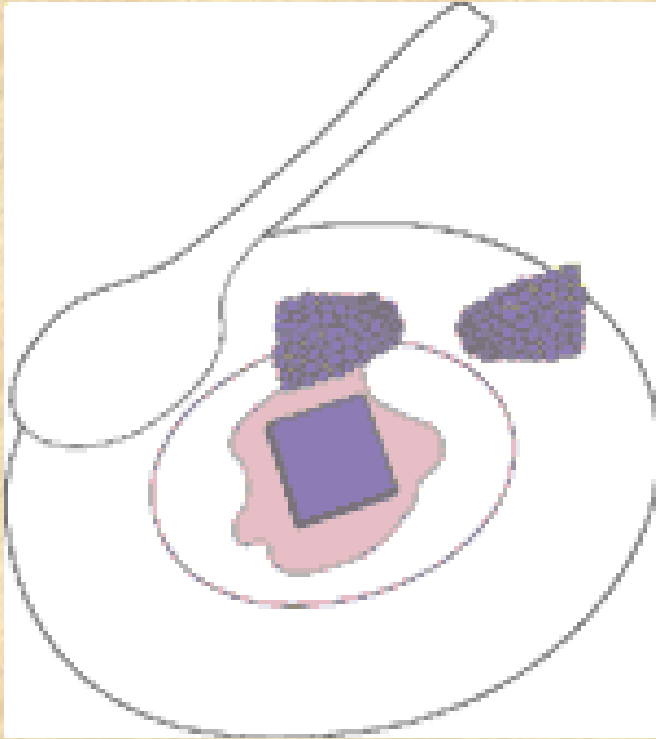
- After testing to determine which side is conductive, one of the glass slides is then masked off 1-2 mm on **THREE** sides with masking tape. This is to form a mold.
- A couple of drops of the titanium dioxide suspension is then added and distributed across the area of the mold with a glass rod.
- The slide is then set aside to dry for one minute.



کلسیناسیون سلول خورشیدی

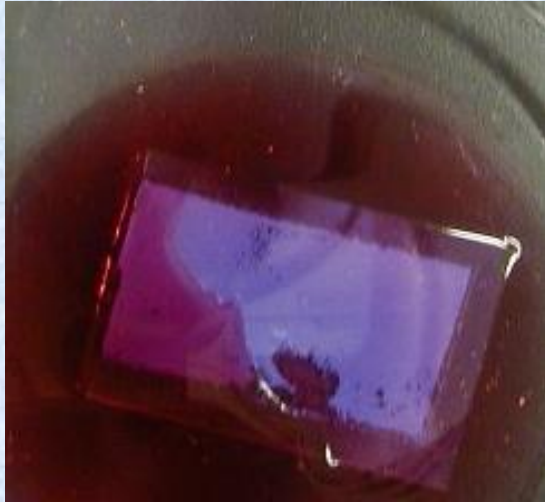


- After the first slide has dried the tape can be removed.
- The titanium dioxide layer needs to be heat sintered and this can be done by using a hot air gun that can reach a temperature of at least 450 degrees Celsius.
- This heating process should last 30 minutes.



- Crush 5-6 fresh berries in a mortar and pestle with 2-ml of de-ionized water.
- The dye is then filter through tissue or a coffee filter and collected.
- As an optional method, the dye can be purified by crushing only 2-3 berries and adding 10-ml of methanol/acetic acid/water (25:4:21 by volume)

جذب رنگ و پوشش الکتروود

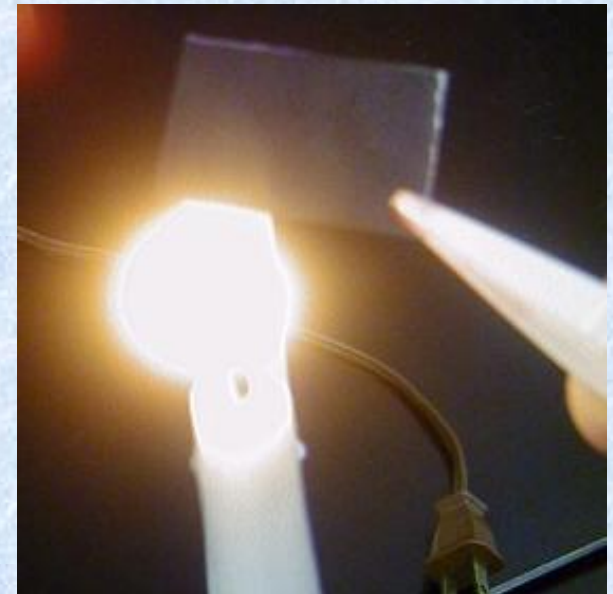


- Allow the heat sintered slide to cool to room temperature.
- Once the slide has cooled, place the slide face down in the filtered dye and allow the dye to be absorbed for 5 or more minutes.

• While the first slide is soaking, determine which side of the second slide is conducting.

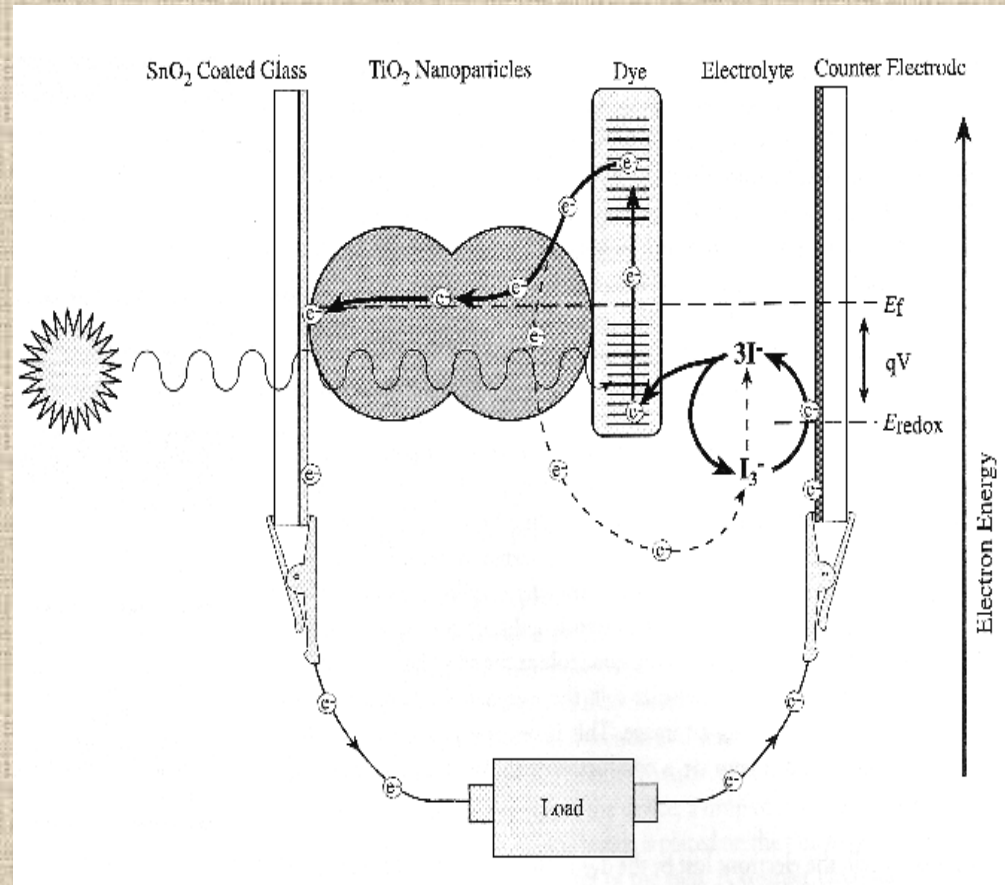
• Place the second slide over an open flame and move back and forth.

• This will coat the second slide with a carbon catalyst layer



چگونه سلول کار می کند؟

1. The dye absorbs light and transfers excited electrons to the TiO_2 .
2. The electron is quickly replaced by the electrolyte added.
3. The electrolyte in turns obtains an electron from the catalyst coated counter electrode.

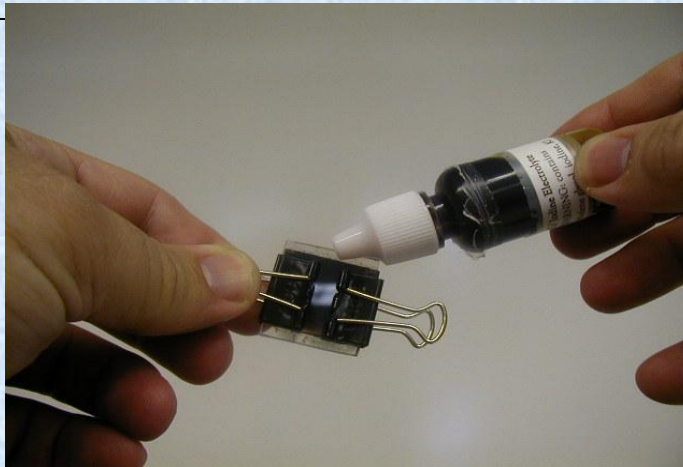
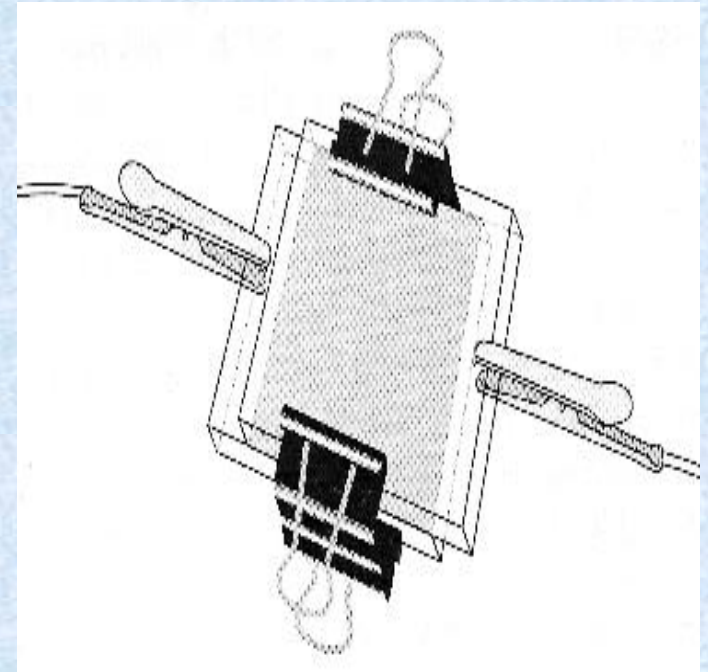


TiO₂ = electron acceptor;
Dye = photochemical pump

Iodide = electron donor;

Assembling the Solar Cell

- After the first slide had absorbed the dye, it is quickly rinsed with ethanol to remove any water. It is then blotted dry with tissue paper.
- Quickly, the two slides are placed in an offset manner together so that the layers are touching.
- Binder clips can be used to keep the two slides together.



• One drop of a liquid iodide/iodine solution is then added between the slides. Capillary action will stain the entire inside of the slides

Using the Cell to Measure the Time Constant for an RC Circuit

Materials: solar cell,
Logger Pro, Graphical
Analysis for Windows,
Vernier LabPro,
Voltage/Current probe,
Pasco RC Circuit Board



با تشکر از توجه شما

