

E1-48: Sensitization of nano-porous film of TiO₂ with santalin (red sandalwood pigment) and construction of dye-sensitized solid-state photovoltaic cell

K Tennakone, G R R A Kumara, I R M Kottegoda, V P S Perera,
P S R S Weerasundara

(Institute of Fundamental Studies, Kandy)

Sensitization of nano-porous films of TiO₂ with natural pigments is an interesting area of investigation. However most natural pigments are photo-unstable and undergo rapid degradation. We have found that red pigment santalin extracted from sandalwood is unusually photo-stable. This work discusses construction of photovoltaic cell with nano-porous film of TiO₂, sensitized by santalin.

Red sandalwood was digested in petroleum ether and dichloromethane to remove lipids and other polar compounds. The residue was washed with water and red pigment was extracted into acetone containing 25% water. This was further purified by chromatography. Nano-porous film of TiO₂ was coated on conducting tin oxide (CTO) glass plate from a colloidal solution of TiO₂ prepared by hydrolysis of titanium isopropoxide. The TiO₂ plate was coated with dye by boiling it in a solution of santalin in acetone. A solution of CuI prepared by dissolving CuI in acetonitrile was coated on the dyed surface of the plate. The electrical contacts were made by pressing a gold coated CTO glass plate onto the CuI surface.

The cell produced a photocurrent of 6 mA/cm^2 and photovoltage of 450 mV at 800 W/m^2 simulated sunlight. The absorption spectra of santalin and santalin coated TiO_2 indicated strong complexation between TiO_2 and santalin. The maximum energy conversion of the cell at 800 W/m^2 simulated sunlight is 2.8% but at low intensities, efficiency increased to 5% . The low efficiency of the cell at higher intensities is an indication of the presence of recombination losses via voids of the TiO_2 .