

**Topic:** One Dimensional TiO<sub>2</sub> Preparation and Dye-sensitized Solar Cell Applications

**Name of Student:** Miss Methawee Nukunudompanich      **Student ID:** 56300700508

**Name of Supervisor:** Assoc. Prof. Dr. Jatuphorn Wootthikanokkhan

**Name of Co-Advisor:** Dr. Surawut Chuangchote

## ABSTRACT

Dye-sensitized solar cells (DSSC) are expected to substitute for silicon solar cells due to its lower costs. Most general electrodes used in DSSCs are fabricated with interconnected TiO<sub>2</sub> nanoparticles that contain large surface areas for adsorbing dye molecules and acting as electron transportation pathways. However, the random contacts among TiO<sub>2</sub> nanoparticles-form grain boundaries, leading to trapping and recombination of electrons with holes, and limits the efficiency of the DSSCs. Alternatively, TiO<sub>2</sub> nanowires, i.e. nanorods or nanotubes, have been proposed as a promising materials for the working electrode due to its large surface area and high electron transportation capability through the TiO<sub>2</sub> nanowires. Among various synthesis methods, anodic aluminum oxide template method (AAO) is one that the film with uniform one-dimensional (1-D) pore channels is used as a template for nanowires. This method is adaptable for applicability and uniformly ordered structure. In this research, changing the AAO hole diameter (100 and 200 nm) of the nanorods and the semi-nanotubes were synthesized by simple ways, *i.e.* immersion setting (nanorods) and vacuum and drop setting (nanowire)- The synthesized nanorods or semi-nanotubes were mixed with commercial TiO<sub>2</sub> nanoparticles (P-25, PlasmaChem GmbH) with mixing ratios of 5:95, 10:90 and 15:85 (by mass) and then utilized as photoelectrode of DSSCs. The optimum mixing ratios for the nanorods and the semi-nanotubes are 5:95 and 10:90, respectively. The DSSCs with photoelectrodes made using the nanorods or the semi-nanotubes showed better performances than those with electrodes made using only TiO<sub>2</sub> nanoparticles, because of the effects of one-dimensional (1-D) nanostructure.

**Keywords:** Anodic aluminum oxide (AAO), Dye-sensitized solar cell (DSSC), TiO<sub>2</sub>, Nanorod, Nanotube.