# Development of metal-oxide nanostructures for application in optoelectronic devices

**Project Leader**

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**Faculty Members Involved in this Project**

None.

**Objective**

We are working on the synthesis of thin film and nanostructures based on metal-oxide-semiconductor materials such as ZnO and $TiO_2$, using various techniques including radio frequency sputtering, mist CVD, spin-coating, solution and hydrogen-thermal methods. It is anticipated that well-aligned nanostructures can be designed for applications including photovoltaic devices, sensors, phosphor, and antibacterial agents. We are seeking to build nanostructures that are high-performance, highly efficient, low-cost, and environmentally friendly.

**Project Outline**

1) Synthesis and evaluation of nanomaterial and nanostructures.
    a) Deposition of thin film using radio-frequency sputtering, solution or mist CVD methods.
    b) Synthesis of nanostructures by annealing, solution, or hydrogen thermal method.
2) Device fabrication and evaluation.
    a) Fabrication of photovoltaic devices, for example dye-sensitized solar cells, using ZnO nanostructures with or without $TiO_2$ serving as electrodes.
    b) Fabrication of a nanostructured thin film phosphor for use in displays or lighting.
    c) Evaluation of antibacterial activity for the obtained nanostructures.

**Required skills or Knowledge**

1) Study or research background in material science (particularly oxide-metal semiconductor material), optoelectronics, physics, and chemical physics.
2) Experience in the fabrication and evaluation of nano-scale materials.
3) Good English conversation and academic writing skills.

**References**

1) Thickness of ITO thin film influences on fabricating ZnO nanorods applying for dye-sensitized solar cell, X. Li, C. Li et al, Composites Part B: Engineering, 74, 147-152 (2015).
2) Influence of substrates on formation of zinc oxide nanostructures by a novel reducing annealing method, X. Li, C. Li, et al, Nanoscience and Nanatechnology Letters, 5, 1-7(2013).

3) Well-arrayed ZnO nanostructures formed by multi-annealing processes at low temperature, D. Wang, C. Li et al, Physica Status Solidi C, 9,194-197 (2012).

**Contact information**

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