

Metal-oxide Thin Films and Nanostructures Applying for Optoelectronic Devices

Project Leader

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1. Objective

We are working on the synthesis of thin film and nanostructures based on metal-oxide-semiconductor materials such as ZnO and TiO₂, 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, gas sensors, phosphor, and antibacterial agents. We are seeking to build nanostructures that are high-performance, highly efficient, low-cost, and environmentally friendly.

2. Project Outline

- 1) Synthesis and evaluation of nanomaterials and nanostructures.
 - a) Deposition of thin film using radio-frequency magnetron sputtering, solution or mist CVD methods.
 - b) Synthesis of nanostructures by annealing, solution, or hydrogen thermal method.
- 2) Device fabrication and evaluation.
 - a) Fabrication and characterization a novel type of gas sensor using photoluminescence property using ZnO and TiO₂ nanostructures.
 - b) Fabrication and characterization photovoltaic devices, for example dye-sensitized solar cells, using ZnO nanostructures with or without TiO₂ serving as electrodes.
 - c) Fabrication and characterization nanostructured thin film phosphor for use in displays or lighting.

3. Expected Performance

- 1) Research management ability. The candidate will have to make a research plan and define the research in terms of achievable aims, the time required and the processes, etc..
- 2) Team leading and communication skill. Knowing how to work with the other group members and being leader to guide the younger researchers.

3) Personal Effectiveness: Ability to learn, Creativity and innovation, Flexibility and open-mindedness, Self-awareness, Self-discipline, Independent working, etc.

4. 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.
- 4) Good IT skills to manage the data and simulation.

References

- 1) Shengwen Hou, Chaoyang Li, Al-doped ZnO thin film as seeds layer effects on the alignment of ZnO nanorods synthesized in the chemical bath deposition, Thin Solid Films, 605, 37-43 (2016).
- 2) 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).
- 3) Influence of substrates on formation of zinc oxide nanostructures by a novel reducing annealing method, X. Li, C. Li, et al, Nanoscience and Nanotechnology Letters, 5, 1-7(2013).

See my webpage:

<https://www.kochi-tech.ac.jp/profile/en/li-chaoyang.html>

See our admission guidelines:

https://www.kochi-tech.ac.jp/english/admission/ssp_aft19oct/ssp_application_guideline.html

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