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 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, 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 TiO_2 nanostructures.

    b) Fabrication and characterization photovoltaic devices, for example dye-sensitized solar cells, using ZnO nanostructures with or without TiO_2 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 Nanatechnology Letters, 5, 1-7(2013).

See my webpage:

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

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