

Transparent Oxide Semiconductors for Flexible Device

Applications

Project Leader:

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1. Objective

This project is aimed at:

Recently, transparent metal-oxide semiconductors, such as In–Ga–Zn–O (IGZO), have attracted particular attention for use as thin-film transistors (TFTs) owing to their high mobility, extremely low off-current, large-area uniformity, and good reliability. In addition, oxide TFTs are very promising for flexible devices because the oxide semiconductors can be deposited by sputtering, even at room temperature. The aim of this project is to develop materials and processing technologies for transparent oxide TFTs suitable for flexible device applications.

2. Project Outline

To that end, the project will consist of the following phases:

As a “world-first”, we demonstrated liquid crystal displays (LCDs) driven by oxide (ZnO) TFTs in 2005. Recently, we also proposed a novel processing method to achieve high performance IGZO TFT at a maximum processing temperature of 150 °C, which is below the softening temperature of flexible plastic substrates (Ref. 1). Outline of this project are as follows:

- (a) Synthesis of high-quality oxide semiconductors by a low-temperature process
- (b) Improved device performance and reliability of low-temperature processed TFTs
- (c) Analysis of carrier transport in the TFT using device simulation
- (d) Fundamental processing techniques to handle flexible substrate

We have a clean room, including a range of processing equipment for TFT fabrication, such as sputtering, plasma-CVD, dry etching, wet etching, photolithography etc.

3. Required Skills and Knowledge

The successful candidate for this project will have the following knowledge and skills:

- (a) Semiconductor materials and device physics, evaluation techniques of materials and devices
- (b) Material processing techniques (PVDs, CVDs, and photolithography), vacuum system

The SSP candidate is expected to conduct material synthesis and characterization, and fabricate TFT by him/herself.

The most important thing is that the SSP candidate must have the desire not only to work in material research but also to make devices by him/herself.

References

1) S. G. Mehadhi Aman et al., Applied Physics Express 11. 081101 (2018)

Publication list can be found at <http://www.env.kochi-tech.ac.jp/m-furuta/result.html>

See my webpage:

Lab. HP <http://www.env.kochi-tech.ac.jp/m-furuta/>

https://www.kochi-tech.ac.jp/english/power/research/flexible_transparent_electronics_realized_with_oxide_semiconductors.html

See our admission guidelines:

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

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