Kamiya-Katase Lab.

Exploration of novel functional materials and electronic devices

Division of Materials Design, Laboratory for Materials and Structures

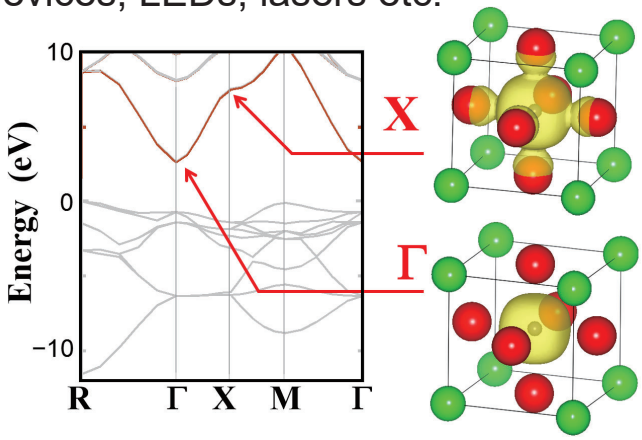
http://www.msl.titech.ac.jp/~tkamiya

- Novel functional devices based on new inorganic semiconductors
- Computer-assisted materials science & materials design
- Innovative materials&devices by nanoscale-controlled thin-film growth

We have been challenging to explore really new functional materials to create novel optical, electronic, energy devices.

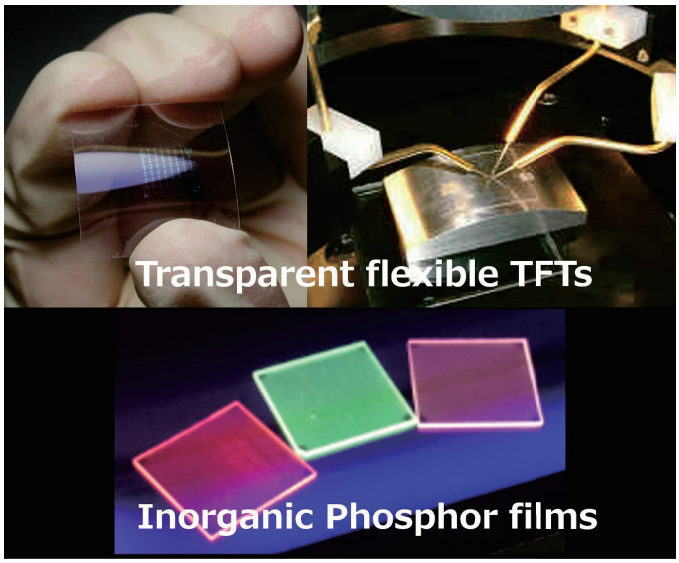
A representative achievement is “IGZO”, which is already commercialized in high-resolution LCD and very large OLED displays. As such, our propose is to find next functional materials following IGZO, that will make our world better and much fascinating.

Based on our original “material design” concepts, we continue to challenge to dramatically enhance the performances of solar cells, transistors, thermoelectric devices, LEDs, lasers etc.



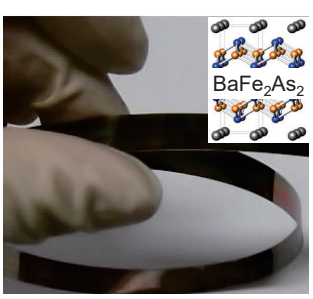
Transparent conductor using covalent bonds

Germanium oxide is known as a good electrical insulator with a wide bandgap over 6 eV. We demonstrated to convert $SrGeO_3$ to a good transparent conductor. Quantum calculation explains its electronic structure and why it reduces the bandgap down to 2.7 eV by employing the cubic $SrGeO_3$ structure. Like this, we are making continuous challenges to create new functional materials based on our original material design concept.

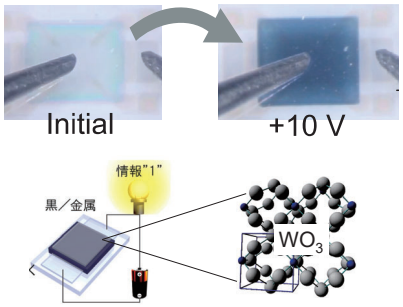


Amorphous oxide for various applications

Before 2004, it had been believed “good semiconductor” can be realized only in crystalline materials such as Si, GaN, and ZnO. Notwithstanding that, we demonstrated the high-performance thin-film-transistor (TFT) can be realized by amorphous oxide “IGZO”, In addition, we recently succeeded to demonstrate room-temperature fabrication of inorganic light-emitting semiconductor films, which will be used for optical devices and displays, replacing OLED in the future.



Super conducting wire using Fe-based material.



Resistance change memory device with multi function such as color modulation.

Nanoscale controlled thin-film growth for novel functional devices

We aim to develop new functional thin-films and opto-electronic/electro-magnetic devices using nanoscale-controlled thin-film growth and high electric-field approach.