

Tutorial 1: Oxide Semiconductors and Application

Hideo Hosono, Tokyo Institute of Technology

Oxide semiconductor has a long research history comparable to Si/Ge semiconductors but almost no distinct device application was seen up to ~2012. Since then, oxide TFTs represented by amorphous IGZO-TFTs are practically used to drive pixels of advanced displays such as high precision LCDs and large-sized OLED-TVs. Oxide semiconductors rather differ from conventional semiconductors such as Si in several respects. This striking difference arises from that in chemical bonding nature, i.e., ionic vs. covalent. Understanding oxide semiconductors in comparison with Si will enable us to get a comprehensive view for semiconducting materials. In this lecture I talk about historical background, chemical bonding, p/n-orientation and band lineup, materials design concept and concrete materials for crystalline and amorphous oxide semiconductors, and application to TFTs as channel semiconductors and perovskite LEDs as electron injection/transport layer. Emphasis is placed on crystalline and amorphous IGZO-TFTs and their characteristics and instability issue. Recent reviews and monographs are also introduced for further reading.