香港城市大學
City University of Hong Kong

Department of Electrical Engineering
Presents a Seminar on

Development of high-performance p-type oxide and halide transistors

by

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Abstract

Developing high-mobility p-type oxide semiconductors with low-temperature, silicon-compatible growth remains challenging in electronics community. An amorphous p-type oxide semiconductor composed of selenium-alloyed tellurium in a tellurium sub-oxide matrix is developed for high-performance p-channel thin-film transistors (TFTs) and complementary circuits. The selenium alloying suppresses hole concentrations and facilitates the *p* orbital connectivity, enabling high performance TFTs with field-effect hole mobility of ~15 $cm^2 \cdot V^{-1} \cdot s^{-1}$ and on/off current ratios of 10^6~10^7 with wafer-scale uniformity. Tin (Sn^{2+}) halide perovskites also emerge as promising p-type candidates but suffer from high film defect density. High-crystallinity cesium-tin-triiodide-($CsSnI_3$) based semiconducting layers with superior Hall mobilities are introduced for TFTs through judicious engineering of film composition and crystallization. The optimized devices exhibit high field-effect hole mobilities of over 50 $cm^2 \cdot V^{-1} \cdot s^{-1}$, current modulation greater than 10^8 and high operational stability. Next, A-site cation engineering method for high-performance pure-Sn perovskite TFTs is introduced, where triple A-cations of caesium-formamidinium-phenethylammonium (CsFAPEA) is used to create high-quality cascaded Sn perovskite channel films with low-defect phase-pure interface. As such, the optimized TFTs show high hole mobilities of over 70 $cm^2 \cdot V^{-1} \cdot s^{-1}$ and on/off current ratios of over 10^8, comparable to the commercial low-temperature polysilicon technique level.

Biography

Prof. Yong-Young Noh is the Namgo Chair Professor in the Department of Chemical Engineering at Pohang University of Science and Technology (POSTECH). He is a member of the National Academy of Engineering of Korea (NAEK) and a fellow of the Korean Academy of Science and Technology (KAST). Prof. Noh earned his Ph.D. from Gwangju Institute of Science and Technology (GIST), followed by two years of postdoctoral research at the Cavendish Laboratory, University of Cambridge. His research focuses on advanced semiconductor technologies, including metal halide perovskites, p-type metal oxide semiconductors, and 2D van der Waals materials, with the aim of advancing next-generation optoelectronic devices. His academic contributions include over 400 publications with approximately 27,000 citations (Google Scholar). Prof. Noh currently serves as an Editor for *IEEE Transactions on Electron Devices* and an Associate Editor for *Organic Electronics* and the *Journal of Information Display*.

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**** ALL ARE WELCOME ****

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