Thin Film Epitaxy and Electronic Devices of Ultrawide-Bandgap Gallium Oxide

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Hosted by: Prof. Hui PAN

Abstract

Gallium oxide (Ga_2O_3) is an emerging ultrawide bandgap semiconductor that has broad application in the field of new-generation information technology. The epitaxial growth of gallium oxide thin films with tunable transport properties is the basis for fabricating high-performance electronic devices. However, synthesis-induced defects and mixed phases usually compromise the device performance. To address this problem, we have systematically investigated phase control, composition tuning and transport properties of gallium oxide thin films. In combination with substrate orientation and extrinsic doping, we have examined the crystallization behavior of different metastable polymorphs, and selectively stabilized phase-pure β-, α- and ε-gallium oxide thin films over the heterogeneous sapphire substrate. The dopant selection and activation in gallium oxide thin films are further examined, and a wide range of conductivity modulation is achieved. Two types of kilovoltage-level Ga_2O_3 -based power diodes are designed and presented. Finally, the influence of defect distribution on photocarrier transport in Ga_2O_3 films is discussed, in an effort to achieve directional carrier transport and collection for high-performance deep ultraviolet photodetectors.

Biography

Prof. Wenrui ZHANG is a Professor of Yongjiang Laboratory and University of Chinese Academy and Sciences since 2020. He received his PhD from Texas A&M University at 2015. After that, He performed postdoctoral research at Brookhaven National Laboratory and Oak Ridge National Laboratory during 2016-2020. His research specializes on thin film epitaxy of functional oxides and ultrawide-bandgap semiconductors, emerging transport behavior and device application for next-generation power devices and deep ultraviolet photodetectors. He has published more than 110 peer-reviewed journal articles with a total citation over 5000 times and a H-index of 39. He serves as Editorial board of Electronics and Advisory panel of Journal of Physics D: Applied Physics.