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Crystal growth of gallium oxide based wide bandgap semiconductors

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The success in obtaining high quality β-Ga_2O_3 bulk substrates has positioned this material as a strong candidate for next-generation devices such as ultraviolet light emitting diode and photodetector. These achievements should be followed by bandgap engineering because it allows great flexibility in designing and optimizing the devices. A wider bandgap range is of great merit as it allows the design of devices such as high sensitive wavelength-tunable photodetectors, cutoff wavelength-tunable optical filters in more broad range. Al is a candidate to enlarge the bandgap of Ga_2O_3 because Al_2O_3 has a larger bandgap (~8.8 eV) and the similar electron structures of Al and Ga makes the alloy $(AlGa)_2O_3$ possible. In this work, we reported on the crystal growth and characterization of $(AlGa)_2O_3$ films. We fabricated (AlGa)2O3 films on (0001) sapphire substrates by pulsed laser deposition using a KrF excimer laser source with wavelength 248 nm. The measurement of bandgap energies by examining the onset of inelastic energy loss in core-level atomic spectra using X-ray photoelectron spectroscopy has proved to be valid for determining the bandgap of $(AlGa)_2O_3$ films as it is in good agreement with the bandgap values from transmittance spectra. The measured bandgap of $(AlGa)_2O_3$ films increases continuously with the Al content covering the whole Al content range from about 5 to 7 eV. Recent progress on these materials will be presented.

Biography

Qixin Guo has received BE, ME, and PhD degrees in Electronic Engineering from Toyohashi University of Technology in Japan in 1990, 1992, and 1996, respectively. He is currently a Professor of Department of Electrical and Electronic Engineering, Saga University in Japan as well as Director of Saga University Synchrotron Light Application Center. His research interests include epitaxial growth and characterization of semiconductor materials. He has published more than 260 papers in scientific journals including *Nature Communications, Advanced Materials, Physical Review B,* and *Applied Physics Letters.*

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