TF-009

Fabrication of GaN Ring Structure with Broad-band Emission Using MOCVD and Wet Etching Techniques

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Recently, many groups have attempted to fabricate 3-dimensional (3D) structures of GaN such as pyramids, rods, stripes and annulars. Since quantum structures on non-polar and semi-polar planes of 3D structures have less influence of internal electric filed, multi quantum wells (MQWs) formed on those planes have high quantum efficiency. Especially, pyramidal and annular structures consist of various crystal planes with different emission wavelength, providing a possibillity of phosphor-free white light emtting diodes (WLEDs).[1] However, it still has problem to obtain high color rendering index (CRI) number because of narrow-band emission and poor indium composition caused by the formation of few number of facets during metal-organic chemical vapor deposition growth.[2] If we can fabricate 3D structure having more various facets, we can make broad-band emittied WLEDs and improve CRI number. In this study, we suggest a simple method to fabricate 3D structures having various facet and containing high indium composition by means of a combination of metal-organic chemical vapor deposition and wet chemical etching techniques.

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[2] Q. Sun, Christopher D. Yerino, Benjamin Leung, Journal of Applied Physics, Vol 110, 053517, 2011

Keywords: GaN, structure, LED, MOCVD, KOH, wet etching

TF-010

Electron Scattering at Grain Boundaries in Tungsten Thin Films

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Tungsten (W) is recently gaining attention as a potential candidate to replace Cu in semiconductor metallization due to its expected improvement in material reliability and reduced resistivity size effect. In this study, the impact of electron scattering at grain boundaries in a polycrystalline W thin film was investigated. Two nominally 300 nm-thick films, a (110)-oriented single crystal film and a (110)-textured polycrystalline W film, were prepared onto (11-20) Al2O3 substrate and thermally oxidized Si substrate, respectively in identical fabrication conditions. The lateral grain size for the polycrystalline film was determined to be 119±7 nm by TEM-based orientation mapping technique. The film thickness was chosen to significantly exceed the electron mean free path in W (16.1 and 77.7 nm at 293 and 4.2 K, respectively), which allows the impact of surface scattering on film resistivity to be negligible. Then, the difference in the resistivity of the two films can be attributed to grain boundary scattering. quantitative analyses were performed by employing the Mayadas-Shatzkes (MS) model, where the grain boundary reflection coefficient was determined to be 0.42±0.02 and 0.40±0.02 at 293 K and 4.2 K, respectively.

Keywords: tungsten, electron scattering, interconnection, thin films