

Ridge Formation by Dry-Etching of Pd and AlGaIn/GaN Superlattice for the Fabrication of GaN Blue Laser Diodes

김재관¹, 이동민¹, 박민주¹, 황성주¹, 이성남², 곽준섭¹, 이지현^{1†}

¹순천대학교 재료금속공학과, ²한국산업기술대학교 나노-광공학과

In these days, the desire for the precise and tiny displays in mobile application has been increased strongly. Currently, laser displays ranging from large-size laser TV to mobile projectors, are commercially available or due to appear on the market [1]. In order to achieve a mobile projectors, the semiconductor laser diodes should be used as a laser source due to their size and weight. In this presentation, the continuous etch characteristics of Pd and AlGaIn/GaN superlattice for the fabrication of blue laser diodes were investigated by using inductively coupled CHF₃ and Cl₂ -based plasma. The GaN laser diode samples were grown on the sapphire (0001) substrate using a metal organic chemical vapor deposition system. A Si-doped GaN layer was grown on the substrate, followed by growth of LD structures, including the active layers of InGaIn/GaN quantum well and barriers layer, as shown in other literature [2], and the palladium was used as a p-type ohmic contact metal. The etch rate of AlGaIn/GaN superlattice (2.5/2.5 nm for 100 periods) and n-GaN by using Cl₂ (90%)/Ar (10%) and Cl₂ (50%)/CHF₃ (50%) plasma chemistry, respectively. While when the Cl₂/Ar plasma were used, the etch rate of AlGaIn/GaN superlattice shows a similar etch rate as that of n-GaN, the Cl₂/CHF₃ plasma shows decreased etch rate, compared with that of Cl₂/Ar plasma, especially for AlGaIn/GaN superlattice. Furthermore, it was also found that the Pd which is deposited on top of the superlattice couldn't be etched with Cl₂/Ar plasma. It was indicating that the etching step should be separated into 2 steps for the Pd etching and the superlattice etching, respectively. The etched surface of stacked Pd/superlattice as a result of 2-step etching process including Pd etching (Cl₂/CHF₃) and SLs (Cl₂/Ar) etching, respectively. EDX results shows that the etched surface is a GaN waveguide free from the Al, indicating the SLs were fully removed by etching. Furthermore, the optical and electrical properties will be also investigated in this presentation. In summary, Pd/AlGaIn/GaN SLs were successfully etched exploiting noble 2-step etching processes.

REFERENCES

1. World Wide Web in <http://lhc2012.iis.u-tokyo.ac.jp>.
2. S. N. Lee, J. K. Son, H. S. Paek, Y. J. Sung, and K. S. Kim, H. K. Kim, H. Kim, T. Sakong, Y. Park, K. H. Ha, and O. H. Nam, Appl. Phys. Lett. 93, 091109 (2008)

Keywords: Pd, AlGaIn/GaN, Superlattice, Dry etching