In this study, to enhance the emission efficiency of GaN-based near-ultraviolet light-emitting diodes (NUV-LEDs), the ITO/nano-Ag plasmonic window which possessed localized surface plasmon (LSP) coupling effect was prepared on the roughened p-GaN layer. The LSP coupling was generated on the grating nanostructure, resulting from the spin-coated Ag nanoparticles onto the p-GaN layer. To obtain an obvious LSP coupling, the Ag nanoparticles should be distributed on the p-GaN uniformly. Thus, the p-GaN layer was treated via the Ar-plasma treatment, and it confirmed an uniform distribution of Ag nanoparticles can be prepared on the p-GaN. The light output power (@350 mA) of the surface-plasmon-enhanced NUV-LED (SPE-NUV-LED) with the Ar-plasma treated p-GaN possessed 73.7% improvement compared with that of the conventional NUV-LED (CNUV-LED). This improvement can be attributed to the formation of LSP effect in Ag nanoparticles embedded in the roughened p-GaN, resulting from the coupling between the excitons in MQWs and the LSP in Ag nanoparticles.

Keywords: localized surface plasmon coupling effect
Ag nanoparticles
Light emitting diodes

REFERENCES