
シンポジウム(口頭講演) | シンポジウム | 日韓ジョイントシンポ：ワイドバンドギャップ半導体デバイス

[19p-CE-1~4]日韓ジョイントシンポ：ワイドバンドギャップ半導体デバイス

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久保 俊晴(名工大)

2018年9月19日(水) 13:00 ~ 14:45 CE (センチュリーホール)

△：奨励賞エントリー

▲：英語発表

▼：奨励賞エントリーかつ英語発表

空欄：どちらもなし

13:00 ~ 13:30

▲[19p-CE-1]Enhanced Light Extraction from AlGaIn Deep-Ultraviolet Light-Emitting Diodes

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キーワード：light-emitting diodes, deep ultraviolet LED, AlGaIn

Despite a rapidly-growing demand for efficient man-made deep-ultraviolet (DUV) light sources, widespread adoption of AlGaIn-based DUV LEDs is currently obstructed by extremely poor extraction of DUV photons due to the intrinsic material properties of AlGaIn including low hole concentration and poor light extraction efficiency (LEE). Conventional LEE-enhancing techniques used for GaInN-based visible LEDs turned out to be ineffective for DUV LEDs due to a strong absorption of DUV light by p-GaN contact layer, and predominant TM polarized anisotropic emission from Al-rich AlGaIn multi-quantum well (MQW) active region grown on c-plane sapphire substrate. Therefore, a new LEE-enhancing approach addressing the unique intrinsic property of AlGaIn DUV LEDs is strongly desired.

In this study, we present DUV LEDs having arrays of TC shaped active mesas coated with MgF₂/Al reflectors on the inclined sidewalls to extract strong TM-polarized in-plane emission through the sapphire substrate. Ray tracing simulations reveal that the TC DUV LEDs show an isotropic emission pattern and much enhanced light-output power in comparison with stripe-type DUV LEDs with the same MgF₂/Al reflectors. Consistent with the ray tracing simulation results, the TC DUV LEDs show an isotropic emission pattern with 37.1% higher light-output power as well as lower operating voltage than the stripe-type DUV LEDs. Based on our results, we suggest strategies to design an optimized DUV LEDs for further enhancing the optical and electrical performances simultaneously. In addition, we propose a next generation DUV LED with an array of Al nanoparticles capable of enhancing IQE and LEE simultaneously by surface plasmon resonance coupling.