Deep-ultraviolet and Visible Dual-Band Diode for Efficient Optical Wireless Communication Systems

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Introduction

Most optical wireless communication (OWC) systems only demonstrate either visible light communication (VLC) [1] or solar-blind [2, 3] and never realize them together in one system with a compact size that possesses multi-band communication capability. Herein, we propose a new LED architecture to build a highly efficient dual-band AlGaN-based diode by coating quantum dots (QDs) at the backside of the device with an optimized layer thickness [4]. Strikingly, the device exhibits effective 275 and 470 nm DUV-visible dual-wavelengths.

Methods

Two device architectures have been presented, in device-one, the QDs are deposited at the backside of the micro-LED array with controlled thickness, and in device-two, the QDs are coated at one portion of the device, (Fig. 1a and 1b).

Results

An optical image of device one and device two can be seen in Fig. 1c and 1d. The EL response from device-one, emitting simultaneous dual-band of 275 nm and 470 nm (Fig. 1e). Device-two shows the controllable dual-band emission (Fig. 2f, and 2g). We obtained a bandwidth of 254 MHz for SBC and 36 MHz for VLC using device-one and 222 MHz and 96 MHz for SBC and VLC using device-two, see Fig. 2h and 2i. Further device-two can be used for dual-band secure communication, and UV to visible optical signal converter.

Conclusion

Our work proposes a cost-effective and universal light emitting strategy with a compact device size for achieving high-speed dual-band optical communication systems, capable of being operational in solar blind and underwater application scenarios.