

# Deep UV micro-LED arrays for optical communications

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Deep ultraviolet (UV) optical communications have attracted considerable attention recently. As most of the Sun's ultraviolet radiation is absorbed by the ozone layer in Earth's stratosphere, UV optical communications offer not only a high-security communication link between satellites in the upper atmosphere, but also data transmission with low solar background noise for outdoor communication on the ground. Furthermore, deep UV light is strongly scattered in the air caused by abundant molecules and aerosols, which enables non-line-of-sight short-range optical communication. However, in comparison with visible light communications, the data transmission rate based on deep UV light emitting diodes (LEDs) has been little explored and is still quite low. This is mainly due to the low modulation speed of conventional deep UV-LEDs. Therefore, developing high speed deep UV-LEDs is of paramount importance.

In recent years, we have developed the micro-LEDs ( $\mu$ LEDs) as novel high-speed transmitters for visible light communications.<sup>1</sup> These  $\mu$ LEDs, of edge dimension/diameter typically in the 10-100 $\mu$ m range, have extremely high modulation bandwidths due to their high operating current densities. Based on these studies, we report here the first III-nitride deep UV- $\mu$ LED array emitting at around 262 nm to demonstrate its full potential for deep UV optical communications. This array consists of 15  $\mu$ LED elements with a flip-chip configuration. With an emission area of 565.5  $\mu\text{m}^2$ , each  $\mu$ LED element is individually addressable. The UV optical power of a single  $\mu$ LED element is 196  $\mu\text{W}$  at 3.4  $\text{kA}/\text{cm}^2$  direct-current (DC) operating current density. We are currently measuring the modulation bandwidth of these deep UV- $\mu$ LEDs. As they can sustain such a high DC operating current density, we expect a high modulation bandwidth and, in turn, a high data transmission rate for fast free-space optical communication. These results will be presented in the conference.

[1]. S. Rajbhandari *et al.*, "A review of gallium nitride LEDs for multi-gigabit-per-second visible light data communications", *Semicond. Sci. Technol.*, **32**, 023001 (2017).

Acknowledgement: This work was supported by EPSRC grants EP/K00042X/1 and EP/M01326X/1. We gratefully acknowledge our colleagues in the former programme for their assistance with the data communications demonstrations.