Supplementary Material

Bandwidth enhancement in an InGaN/GaN three-section superluminescent diode for optical coherence tomography

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In this supplementary material, we provide additional spectra and light output power results of the three-section InGaN-based superluminescent light emitting diodes (SLEDs).

S1. Emission properties of three-section SLEDs with the same current density applied to the front two sections

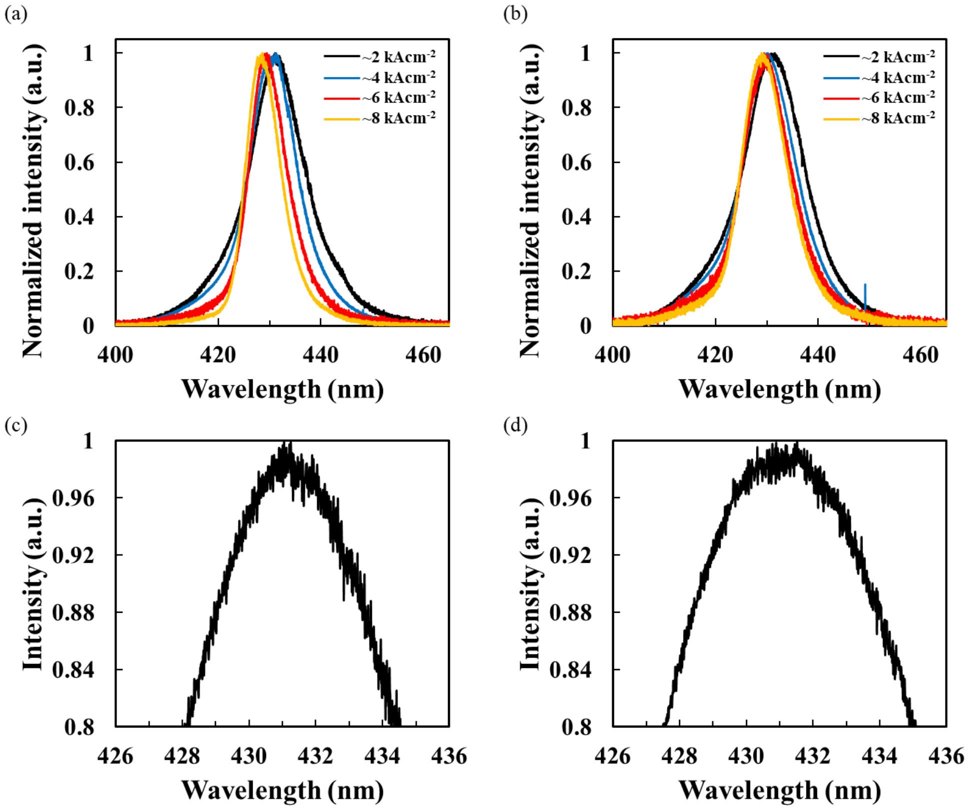

FIG. S1. Emission spectra with increasing current when the absorber is operated in (a) O/C and (b) S/C, magnified emission peakwith ~2 kAcm^{-2} current injection and the absorber in O/C and (d) S/C.

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Fig. S1 (a) and (b) plots normalized SLED emission spectra from 400-460 nm under pulsed operation, when current densities of ~2, ~4, ~6 and ~8kA /cm^2 are applied to the front two sections of the device with the rear absorber section operated in a) open circuit (O/C) and b) short circuit (S/C). For all applied current densities super luminescence is shown, with no indication of burn through. All the samples show a blue shift of the emission wavelength as the current density on gain sections increased. Fig. S1 (c) and (d) plots magnified emission peaks with ~2kAcm^{-2} applied to the device with the absorber in O/C and S/C, respectively. A spectral ripple can be observed for both cases, showing amplified spontaneous emission is occurring.

S2. Electrical properties of three-section SLEDs

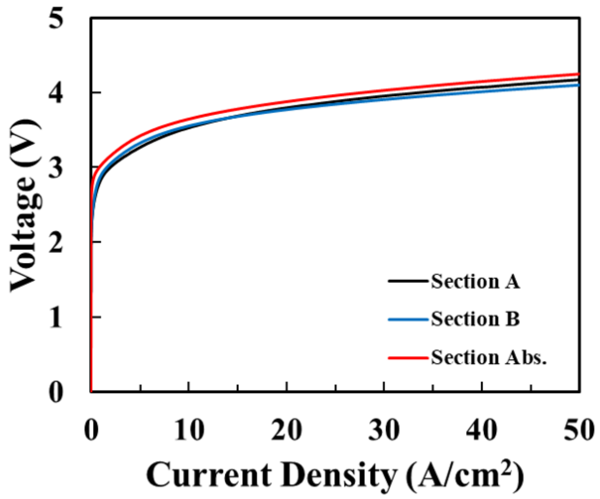

FIG. S2. J-V characteristics of three-section InGaN based blue SLEDs (430 nm)

Fig. S2 shows the voltage as a function of current density (J-V) for the three-section blue SLEDs operating continuous wave at room temperature. Isolation between contacts was more than 1.25 kΩ. Each section of the SLEDs exhibits similar J-V dependences, and has a relatively low (dV/dI) series resistance (≤ 1 Ω).

S3. Emission spectra of three-section SLEDs with different current density on front two gain sections

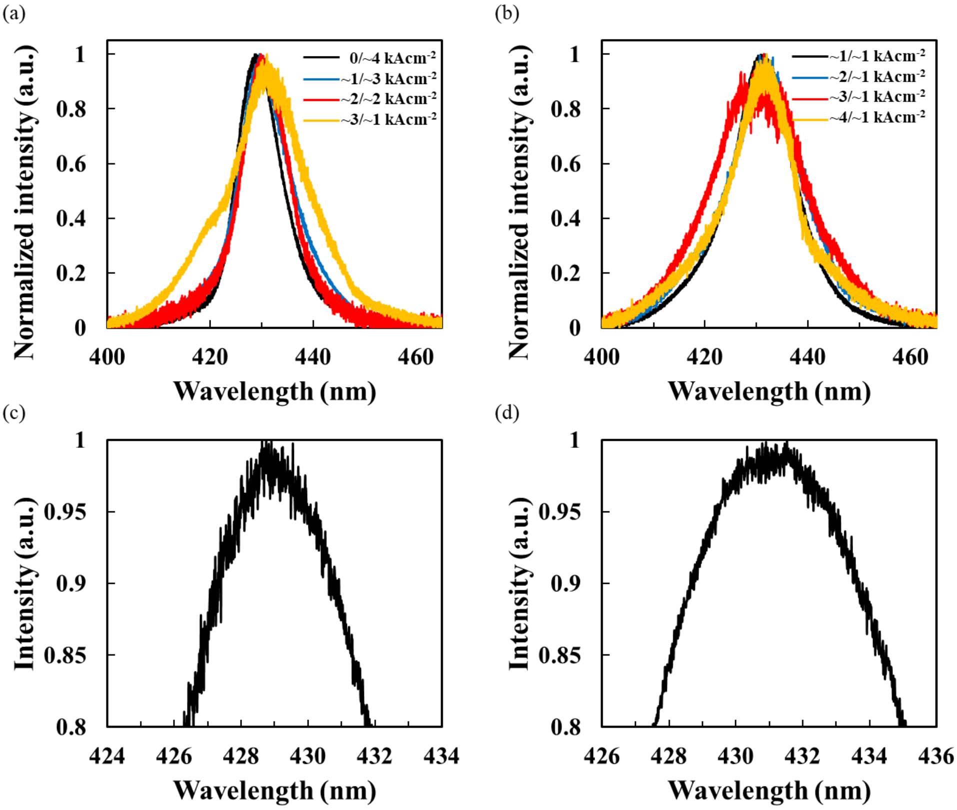

FIG. S3. Independently injected current-density dependence of emission spectra with (a) O/C and (b) S/C operated absorber, magnified emission peak with (c) 0/~4 kAcm^{-2} operation with O/C absorber and (d) ~1/~1 kAcm^{-2} operation with S/C absorber.

Fig. S3 (a) and (b) show normalised emission spectra of the multi-section SLEDs from 400-460 nm under pulsed operation with the absorber section operated in O/C and S/C, respectively, with differing currents applied to the front two sections. Although the front two sections of the SLED are independently pumped, the overall current density applied to the SLED is maintained. When the current density applied to the middle section of the SLED is increased to ~3x that in the front section, red shift of the central wavelength is observed when the absorber is in O/C operation. For either the absorber in O/C or S/C, it is noted that the emission bandwidth is maximised when the current density in the middle section is greater than that of the front section. Fig. S3 (c) plots magnified emission peaks with ~0/~4kAcm^{-2} applied to the device with the absorber O/C, and d) with ~1/~1kAcm^{-2} with the absorber S/C.