OPTICAL INVESTIGATIONS OF NANO-LEDS BASED ON MICRON SIZED III NITRIDE PLATELETS

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Introductions

The next generation of displays will be based on micron-sized light emitting diodes (μ-LEDs). Blue and green μ-LEDs in direct emissive displays are based on III-nitrides (InGaN) and the red ones are based on AlGaInP. We investigated the optical properties of μ-LEDs based on submicron sized InGaN platelets, covering the entire visible range.

Methods

The platelets were grown by selective area growth from aN array of submicron-sized holes in a SiN mask on GaN on sapphire substrates. The flat-topped platelets consist of a single InGaN quantum well (QW) in between InGaN barriers, and are virtually dislocation free. The optical properties were studied by hyperspectral cathodoluminescence imaging at room temperature. The study is focused on red-emitting platelets.

Results

When imaging the QW emission in top view, we observe several dark lines, fig 1. These dark lines can also be observed when imaging the barrier emission, leading us to identify these as stacking mismatch boundaries. A series of samples where each layer was added sequentially reveals that the initial platelets are defect free, whereas the dark lines appear already in the first layer. The identification of the dark lines as stacking mismatch boundaries was confirmed by a TEM study.

Conclusion

One key issue with the red-emitting platelets is that typically half of them are affected by dark lines. As these reduce the efficiency of the light emission, it is essential to determine the origin of the defects and to eliminate the source. The latter is the subject of further investigations.