Heterogeneous integration of blue GaN laser diode using electrochemical etching
Chenziyi Mi¹, Rami Elafandy¹, Jung Han¹, Yubo Wang¹, Hong Tang¹, Brad Siskavich², Josh Brown²
1. School of Engineering and Applied Science, Yale University, 2. Bluglass Inc.

**Purpose & Goal**

Heterogeneously integrate GaN blue laser diode to the photonic integrated circuits (PICs)

**Advantages**

- High-performance pumping light source
- Wafer scale integration
- High reliability and long lifetime

**InGaN LD processing**

LD facets formed by dry etching + TMAH polishing

Cross-section SEM of dry etched sidewall

- Cross-section SEM of TMAH polished sidewall with different crystal misorientations

Elimination of parasitic photo-electrochemical etching by performing the TMAH polishing in darkness

**LD characterization result**

- Lasing at 466 nm with a threshold current density of ~5.9 kA/cm²
- Lasing is blue-shifted from EL
- Lasing only occurs with long cavity (>1000 μm) and wide ridge (>8 μm)

**LD liftoff and transfer**

Successful liftoff of LD mesa structures bonded to a handle wafer

**Electrochemical etching and sacrificial layer**

- Conductivity-selective electrochemical etching
- Highly doped sacrificial layer can be electro-polished

**Process flow for liftoff fabrication**

Successful liftoff of LD mesa structures bonded to a handle wafer

**Conclusion**

- Wafer scale transferrable InGaN LD has been developed with a threshold current density of 6kA/cm².
- LD mesa structures have been successfully transferred to a handle wafer with relatively high yield.

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