High efficiency III-nitride LEDs by electrochemical etching with GaN/air DBR

**OCR Number:** OCR 5705

**Description:**

A 1-step electrochemical etch (EC) process for gallium nitride (GaN) epi-wafers post mesa-etch which creates Distributed Bragg Reflector (DBR) mirrors. The result is significantly increased LED light efficiency; photoluminescence testing shows a 5x increase in light intensity. This is a dramatic improvement over the current state of the art, e.g. backscattering by substrate patterning. Etch rate is typically 5 microns/minute.

**Field of Application:** High efficiency photonic devices, including blue/green LED.

**Advantages:**

- 5x improvement in LED light intensity PL test
- High reflectance in blue/green spectral range
- Only 4 GaN membrane required (short cavity - 4 or 5 pairs, not 20 to 30).
- High scaleability: (no UV required in etch process)
- Short preparation and processing time: high etch rate, simple modulation of morphology
- Enhanced photon electron interaction (Purcell effect)

**Stage of Development:** Electrically pumped LED testing regime

**Published/issued Patents:** [U.S. Pub. App. No. 2014003458](#)

**Publications:**

Patent application available under confidentiality

**Licensing Contact:** Richard Andersson
richard.andersson@yale.edu