

# Perovskite Lasers for Silicon Integrated Photonics with Perovskite Gain Layer

**This technology offers an electrically excited laser system with perovskite material as the light emitter. Current lasers are optical and use inorganic materials as the gain layer that contributes to high cost, complex, and high temperature fabrication methods.**

## What is the Problem?

Photonic integrated circuits with their small component size and high integration density have been regarded as a technology that can potentially provide advancement in computing and communication systems. Components in photonic integrated circuits can include lasers, waveguides, modulators, and photodetectors that can be lithographically defined and fabricated on low-cost silicon or other platforms such as glass and flexible substrates to achieve system functionality. Among these, lasers have perhaps been the most challenging to integrate due to somewhat incompatible fabrication processes used respectively for laser gain materials and the substrate materials. Traditional lasers integrated on a silicon platform typically use inorganic materials like GaAs or GaN as a gain layer, which can involve complex, high cost, and high temperature fabrication procedures, such as molecular beam epitaxy growth. Perovskites are a rapidly growing research subject, predominantly as solar energy materials. However, perovskites are sensitive to oxygen and moisture and often degrade in a matter of hours or days, which hinders them from commercial usage.

## What is the Solution?

The solution is a laser system which incorporates a perovskite material as the light emitter, with electrical excitation of the laser, rather than optical. This is compatible with existing silicon technologies. Stability concerns of perovskite are addressed by stabilizing with purification, surface engineering and interface engineering. This electrically pumped perovskite laser for photonic integrated circuits consists of a silicon wafer with etched waveguide, layered by an electron transport layer with a nanoimprinted waveguide, and a top coating of perovskite material.

## What Differentiates it from Solutions Available Today?

Existing lasers are optical, while this laser uses electrical excitation for a perovskite material light emitter. This solution could avoid the typical use of inorganic materials as the gain layer, which would eliminate the high cost, complex, and high temperature fabrication procedures, by

**Technology ID**

BDP 8702

**Category**

Hardware/Semiconductors  
Selection of Available  
Technologies

**Authors**

Lih-Yuan Lin

**Learn more**



moving to perovskites.

**Patent Information:**

[WO2019217771A1](#)