Analytical Instrumentation, Methods & Materials


# Smoother Waveguides for More Efficient Nonlinear Frequency Conversion

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**WARF: P120326US01**

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**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing methods for fabricating orientation-patterned semiconductor structures able to generate visible, mid- or near-infrared light with low optical losses.**

## Overview

For many applications – from remote sensing to laser displays – it is necessary to convert the frequency of light via nonlinear interaction in semiconductor materials. Waveguide devices accomplish this efficiently by receiving radiation from an input source, such as an optical fiber, and directing it along an axis. Upon exiting the other end, the frequency-converted output radiation is collected or redirected for different purposes.

Orientation-Patterned GaAs (OPGaAs) waveguide structures hold promise for efficient, mid-infrared nonlinear frequency conversion. However, thickness variations between the device's layers can degrade performance.

## The Invention

UW–Madison researchers have developed a method for fabricating OPGaAs two-dimensional semiconductor-based waveguides having extremely low layer-interface roughness.

The structure is grown on a template using standard techniques and comprises a core sandwiched between upper and lower cladding layers. The layers have different, periodically arranged crystalline orientations. The surfaces between each layer undergo chemical polishing and isotropic etching that can be done *in situ*. A high-refractive-index ridge projects above the upper cladding layer and runs along the direction that light propagates. Known lithographic techniques and a combination of wet and dry etching create straight, smooth sidewalls.

## Applications

- Laser projection and display
- Spectroscopy
- Optical communication
- Remote sensing
- Infrared countermeasures

## Key Benefits

- Surface roughness no greater than 10 nanometers
- Efficient nonlinear frequency conversion over a broad range
- Low optical loss

## Additional Information

**For More Information About the Inventors**

- Dan Botez
- Thomas Kuech
- Luke Mawst

**Related Intellectual Property**

- View Divisional Patent in PDF format.

**Tech Fields**

- Analytical Instrumentation, Methods & Materials : Lasers
- Semiconductors & Integrated Circuits : Design & fabrication

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867