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Silicon Based Chirped Grating Emitter for Uniform Power Emission

Tech ID: 29034 / UC Case 2017-566-0

ABSTRACT

Researchers at the University of California, Davis, have developed a chirped grating emitter with ultra-sharp instantaneous field of view (IFOV) for optical beam-steering applications.

FULL DESCRIPTION

Optical phased arrays (OPAs) are attractive due to their numerous optical beam-steering applications including: free-space optical interconnect, sensing, data communication and light detection and ranging. Current OPAs, however, lack efficient transfer of energy and a uniform direction and mode of light travel (emission/coupling and propagation) that is required for the longer wavelengths of light used in such beam-steering applications. One way to reduce the surface emission rate is to employ shallow etch depths on silicon but the fabrication of gratings is very difficult.

Researchers at the University of California, Davis, have developed a silicon based OPA platform for far-field pattern beam-steering applications. The platform produces an ultra-sharp IFOV and a uniform emission intensity profile up to 8 mm in length. The platform has been successfully tested to be able to modulate emission rates for a combination of duty cycles with custom grating widths while maintaining a clear far field pattern and uniform power emission over 1 mm length. By integrating silicon with lower refractive index silicon nitride (Si₃N₄), silicon-dioxide (SiO₂) and blazed grating fabrication techniques, the platform produces a narrow beam that does not introduce side lobes and can be used to filter emissions from undesired polarization rotations for top emission efficiency.

APPLICATIONS

- ▶ Beam steering applications such as:
- ▶ Free-space optical interconnect
- ▶ Sensing
- ▶ Data communication
- ▶ Light detection and ranging
- ▶ Optical multi-tiling of several smaller IFOVs to form high-resolution wide IFOVs

FEATURES/BENEFITS

- ▶ Designed for uniform power emission over 8 mm length
- ▶ Can modulate emission rate while maintaining the propagation constant
- ▶ Compatible for large scale integration and packaging
- ▶ Longer coupling lengths
- ▶ Low propagation loss

PATENT STATUS

| Country | Type | Number | Dated | Case |
|--------------------------|---------------|------------|------------|----------|
| United States Of America | Issued Patent | 10,429,588 | 10/01/2019 | 2017-566 |

RELATED MATERIALS

- ▶ Kuanping Shang, Chuan Qin, Yu Zhang, Guangyao Liu, Xian Xiao, Shaoqi Feng, and S.J. B. Yoo, "Uniform emission, constant wavevector silicon grating surface emitter for beam steering with ultra-sharp instantaneous field-of-view," *Opt. Express* 25, 19655-19661 (2017) - 08/21/2017

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OTHER INFORMATION

KEYWORDS

grating emitter, silicon, silicon nitride, silicon dioxide, optics, field of view, optical phased arrays, wavevector, surface emission, beam-steering, power, energy, tiling, multi-tiling, Si₃N₄, SiO₂, Si, OPA, IFOV

CATEGORIZED AS

- ▶ **Optics and Photonics**
 - ▶ All Optics and Photonics
- ▶ **Communications**
 - ▶ Networking
 - ▶ Optical
- ▶ **Nanotechnology**
 - ▶ Electronics

RELATED CASES

2017-566-0

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- ▶ Development of a CMOS-Compatible, Nano-photonic, Laser
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