HIGH EFFICIENCY MONO-ORDER CONCAVE DIFFRACTION GRATING

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Partner institution:

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BACKGROUND

The possibility to acquire a spectrum is determinant in sensing for the accurate detection of biological and chemical species, their discrimination, their quantification, and possibly simultaneous identification.
In the same time, hand-held devices are desired for easy, fast, and ubiquitous detection. On-chip integrated spectrometers provide an answer to these requirements, as they offer a small foot-print, are cheaper to manufacture and more robust (no moving or assembled parts). These devices are expected to be significantly more present in the near future. Additional uses include telecoms and microelectronics, notably with silicon photonics. A high spectrometer efficiency is desired to minimize optical losses, which for detectors translates into a higher sensitivity.

TECHNOLOGY

The invention is a new type of diffraction grating for planar integrated optics, which separates the different wavelengths spatially.
- Monolithic spectrometer/demultiplexer using an elliptical Bragg mirror concave diffraction grating.
- Non-metallic, no deep etching.
- Single fabrication step possible.

COMPETITIVE ADVANTAGES

- Small foot-print.
    - o Smaller size, lower cost, higher yield/reliability, more channels.
    - o Reduction of size ~ 8× vs AWG, or more when many channels.
- High efficiency.
    - o Theoretical efficiency: -0.14 dB (97%), the highest for concave diffraction grating spectrometers.
    - o Higher sensitivity (for sensor), specific applications with low light levels (photon counting).
- Lower polarization-dependent loss (PDL).
- Simplified fabrication (no deep etching, no metal).
- Well suited for silicon photonics.
    - o Detection of biological & chemical species (identification, quantification, multiple detection).
- Miniature spectrometers (stand- alone, optical coherence tomography, etc.).
    - o Hand- held devices desired for easy, fast, ubiquitous detection.
- Optical interconnects for microelectronics.
- Wavelength- division multiplexing for optical telecommunications.

TECHNOLOGY DEVELOPMENTAL STAGE

First device fabricated and tested:
- Efficiency of - 3.0 dB (includes all internal spectrometer losses).
- Channel uniformity: 0.4 dB (over 30 nm).
- Crosstalk of 15 dB.
- These values can be enhanced (as done for other spectrometers) by, e.g., optimization of coupling back to output waveguides (not done so far).
- Potential to achieve theoretical performance.

PATENT STATUS
Pending for the US.

BUSINESS OPPORTUNITY
- An patent- pending technology that is available through Aligo Innovation.
- A licensing opportunity for co- developing the technology into a commercial grade product.
- A unique opportunity to address the fast growing Spectrometer, Sensor and DWDM markets.

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