

Dual-Sided, Blazed Grating Architecture for Compact Waveguides

About Inprentus

Inprentus is a U.S.-based designer and manufacturer of innovative, blazed Augmented Reality (AR) waveguide combiners for Near-Eye Displays (NEDs). Founded in 2012 we serve research, semiconductor, AR, defense and sensing markets globally.

The Challenge: Waveguide 'Real Estate'

AR waveguide combiners are constrained by the physical area required for grating couplers and manufacturing complexity. Traditional layouts limit field-of-view (FOV) and eyebox size while suffering from efficiency losses and eye glow.

Our Solution: Double-Sided Blazed SRGs

Inprentus enables a double-sided waveguide architecture where blazed gratings are distributed across both the world-side and eye-side surfaces. This approach maximizes usable optical real estate, enabling larger FOV and eyebox without increasing physical size.

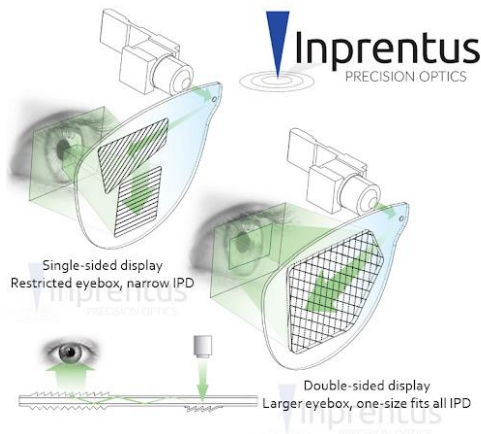


Fig 1. Traditional single-sided layout vs. Inprentus double-sided, blazed architecture showing larger FOV and eyebox.

Advantages of Blazed Architecture

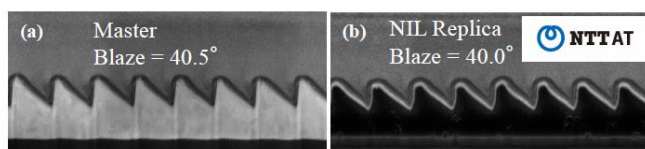


Fig 2. Micrographs of (a) master & (b) replicated grating groove profile.

Inprentus has a simple, one-step manufacturing technology to create blazed grating couplers. Blazed

waveguides provide the widest tunability and free spectral range giving highest performance efficiency. They are also the easiest to replicate.

Technical Validation

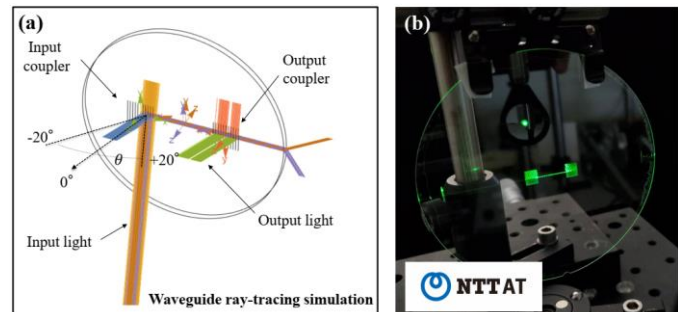


Fig 2. (a) Ray-tracing simulation showing trapped and un-trapped light rays; (b) 543 nm efficiency measurements of two grating prototype

Inprentus has successfully demonstrated high-fidelity replication of blazed SRG masters into high-index waveguides ($n=1.9$ & 1.7) and plastic ($n=1.5-1.6$) waveguides. A two-grating input-output coupler prototype was fabricated and tested via Fizeau interferometry and diffractometer measurements.

Key Results (Two-Grating Demo at AOI = 15 deg):

- Excellent simulation agreement with measured data
- Design ($n=1.7$): Peak efficiency 70%, eye-glow 5%
- Measurements ($n=1.7$): Peak efficiency 48%
- Full three-grating waveguide systems for 1-color design available at 1–5% device efficiency

Manufacturing Capabilities

- Grating types: Blazed SRG, depth & phase modulation
- Blaze angle range: 0.1° to 80° ($\pm 0.1^\circ$ accuracy)
- Pitch uniformity: $\Delta d < 27$ pm across 40 mm patterns
- Sub-wavelength structures: < 1 nm RMS roughness
- Substrate flexibility: Si, glass, Au-coated, or custom

Key Capabilities

- ✓ Domestic supply chain from design to testing
- ✓ NIL and injection molding-compatible geometries (superior to slanted/binary)
- ✓ Proven design + manufacturing + measurement

Contact

info@inprentus.com
+1 (217) 239-9862

Address

51 E. Kenyon Road
Champaign, IL 61820

Web

www.inprentus.com
www.linkedin.com/company/inprentus