Specialty Fibers Pole

Optical fiber manufacturing Flow Chart

Fiber components & FBG'S

Fiber Drawing

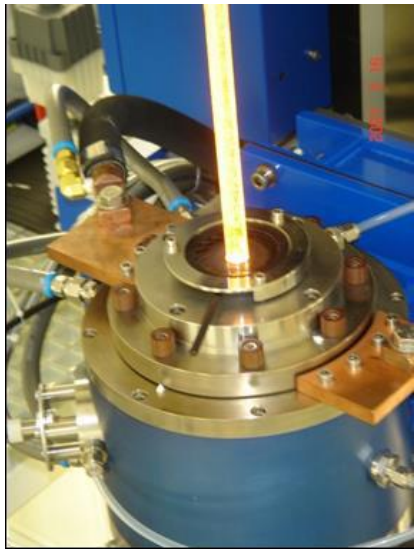
- Fiber Drawing Tower
- Coating systems
- Fiber Characterization Equipment

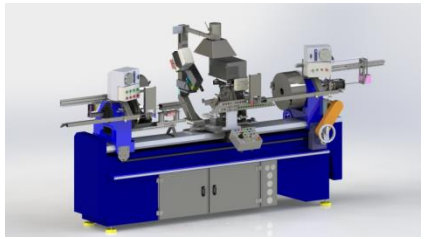
Preform fabrication

- MCVD System
- Preform processing
- Preform Characterization Equipment

Fiber design & simulations

- Beamprop (Rsoft)
- Optifiber (Optiwave)
- Matlab





Available fiber technologies and potential fibers

Special fibers designs:

- NA control
- PCF fibers
- Highly nonlinear fibers
- Polarization maintaining fibers (wavelength conversion, FOG,…)

Active, doped fibers (Er,Yb,Tm,Nd, Etc...) for fiber lasers

- Special internal geometric shape clad: D-shape, Octagonal, …
- Multi-clad fibers (Double clad, 3 or more)
- Large mode area fibers (SM/MM)

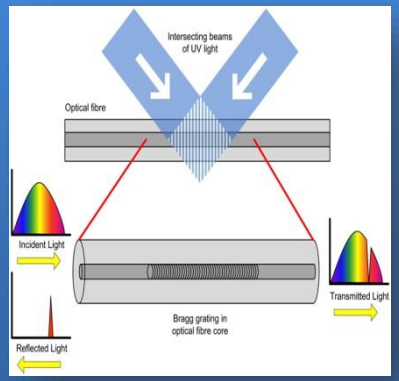
Israel Center for Advanced Photonics
המרכז הישראלי לפוטוניקה מתקדמת

SOREQ

Infrastructure – Fiber Based Devices

Fiber Processing Tools

Bragg Gratings Fabrication

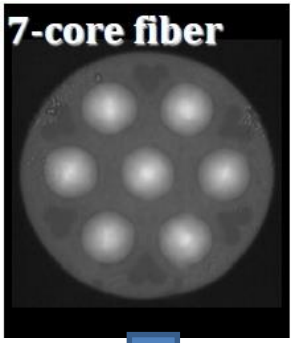


Fiber Components

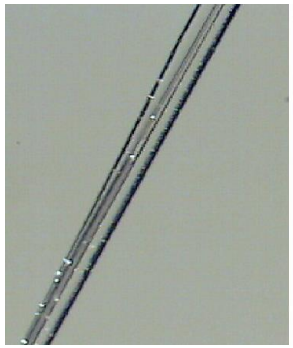
Israel Center for Advanced Photonics
המרכז הישראלי לפוטוניקה מתקדמת

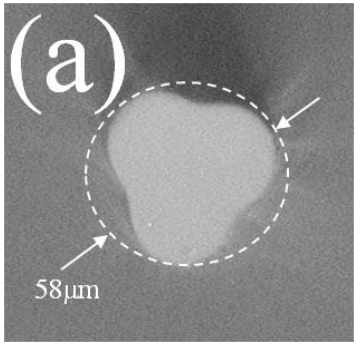
SOREQ

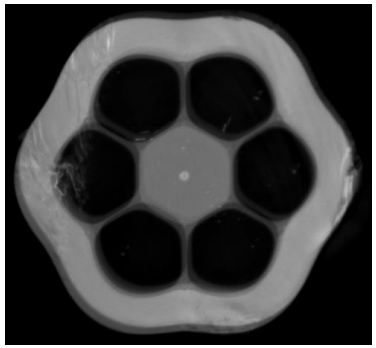
- Side pump couplers
- End pump combiners
- Spectral filters
- Switches
- Tapered Fiber Bundles (TFB)

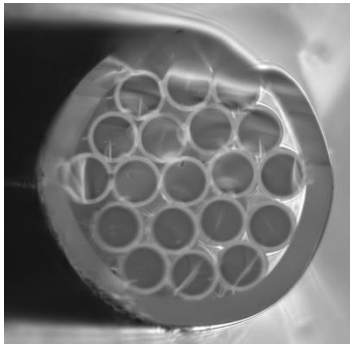


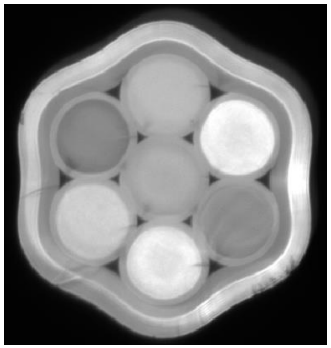
7 to 1 combiner

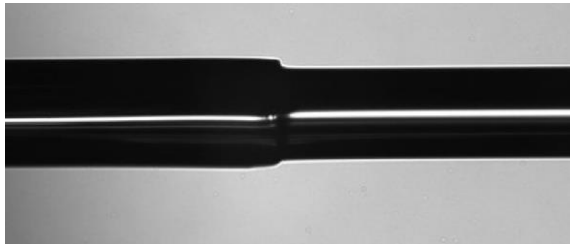


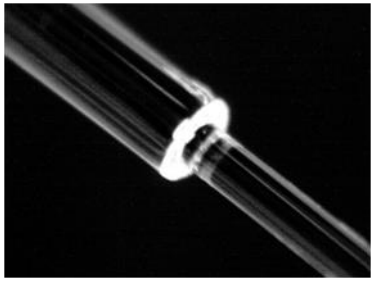


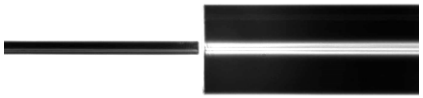






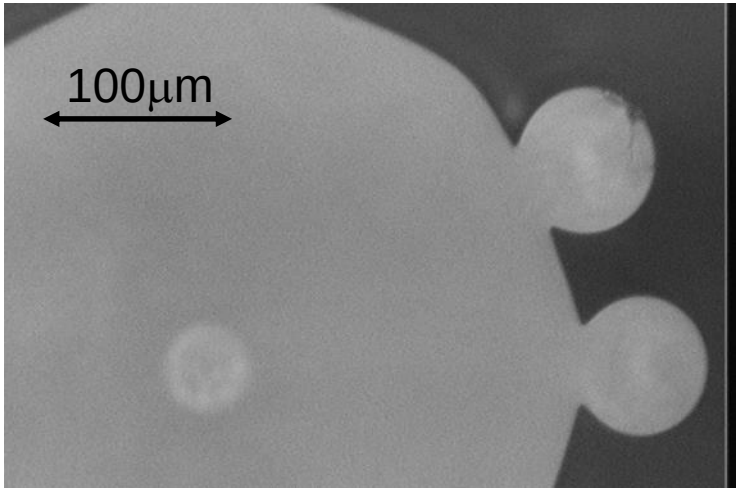


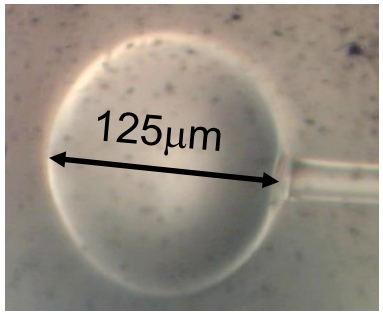




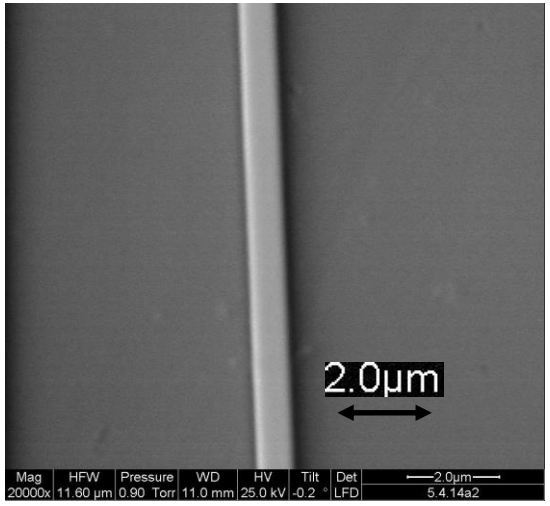
Special glass structures

N x 1 side coupler

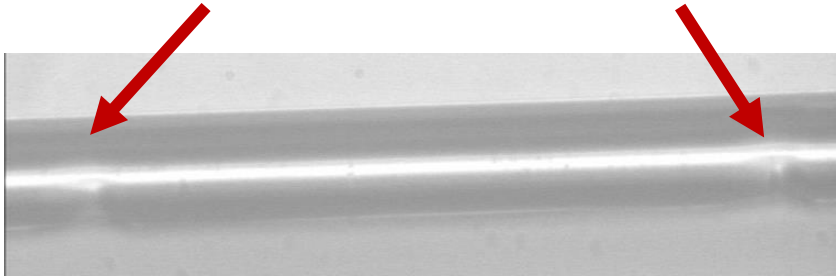




Adiabatic tapering down to sub-microns size



Long Period Grating writing by CO_2 laser

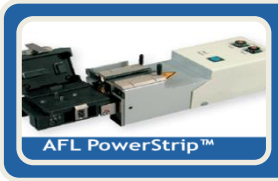


Equipment

Israel Center for Advanced Photonics
המרכז הישראלי לפוטוניקה מתקדמת

SOREQ

Cleavers

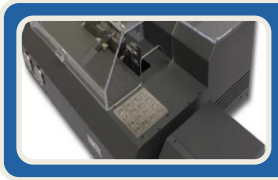


Strippers

Fiber recoaters

Polishers

Fusion Splicers



Fiber processing workstations

Israel Center for Advanced Photonics
המרכז הישראלי לפוטוניקה מתקדמת

SOREQ

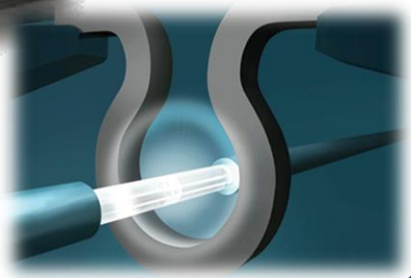
Commercially available machines

Lightel

AFL

3SAE

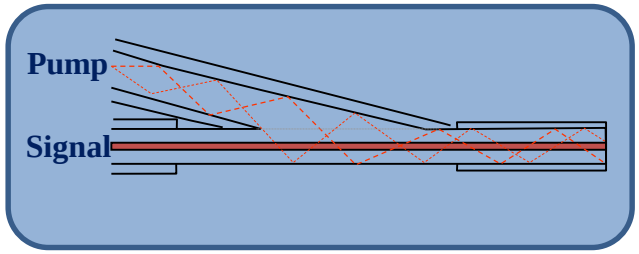
Vytran

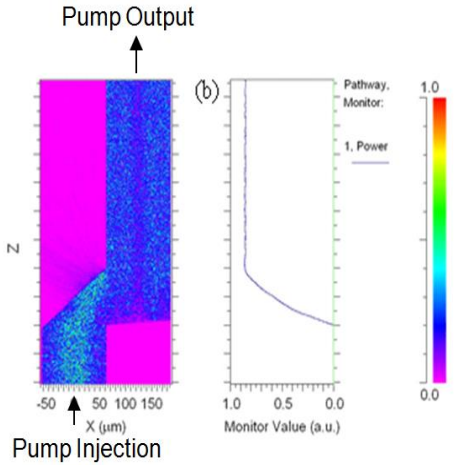


Component Design

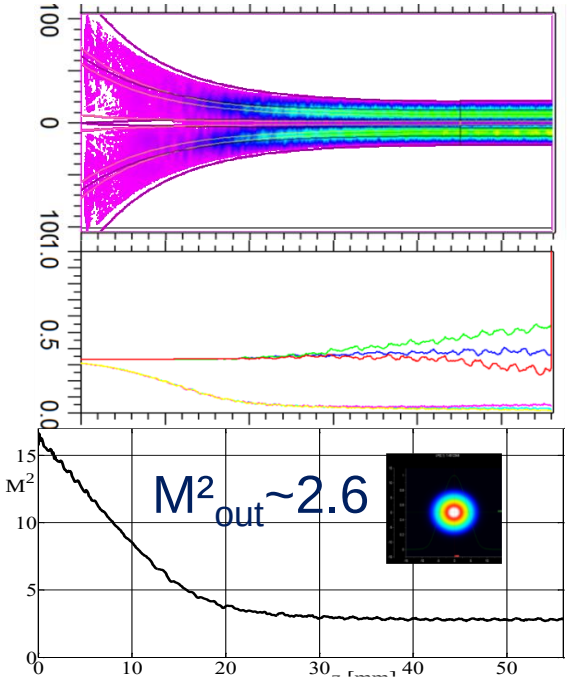
pump combiners, tapers, couplers, gratings, special fibers

Side pump coupler

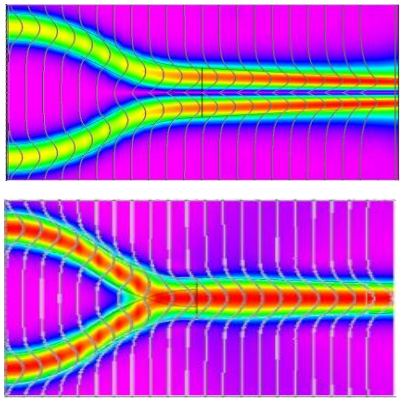




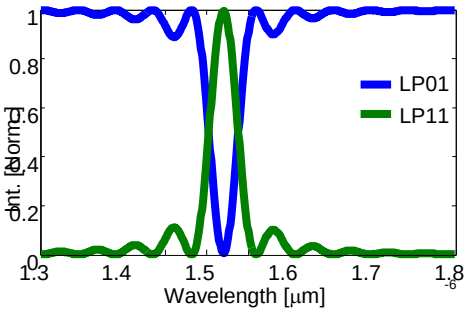
Tapered fiber beam combiner



Coherent beam combiner

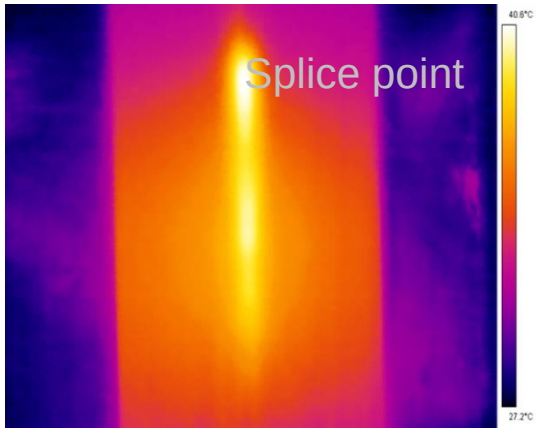


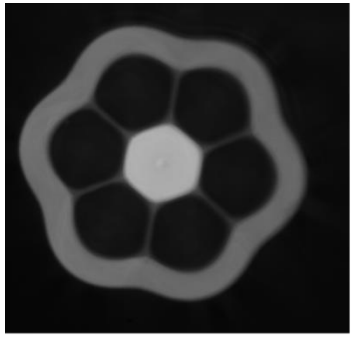
Spectral filter

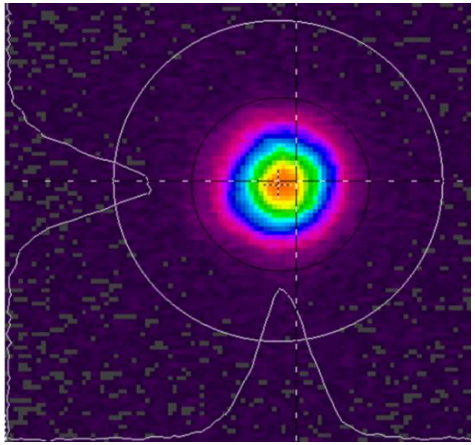


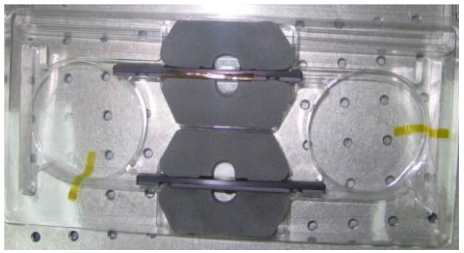
6+1→1 Combiner

- 6+1→1 combiner with 20/200 fiber
  - ✓ 90% signal transmission (97% Transmission on MFA (before the combiner)).
  - ✓ >95% pump transmission all legs.
  - ✓ 900 W pump power achieved (requires active cooling).
  - ✓ M^2 at the delivery fiber output = 1.4



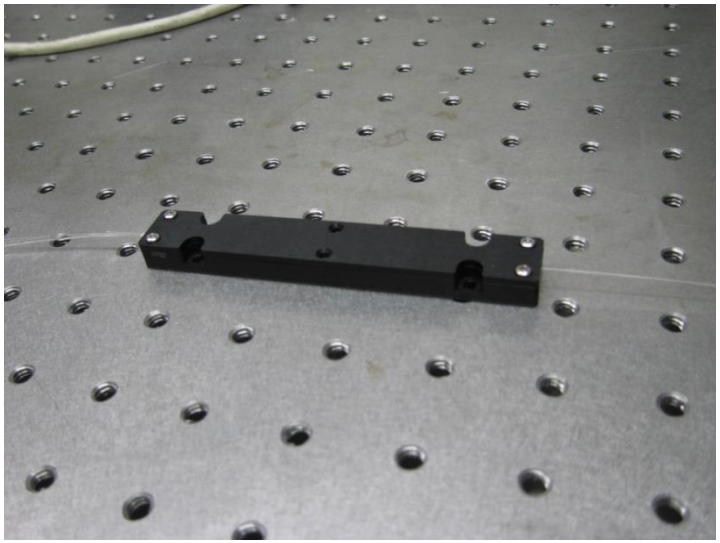


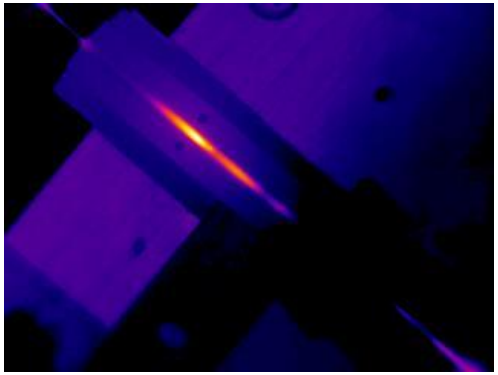


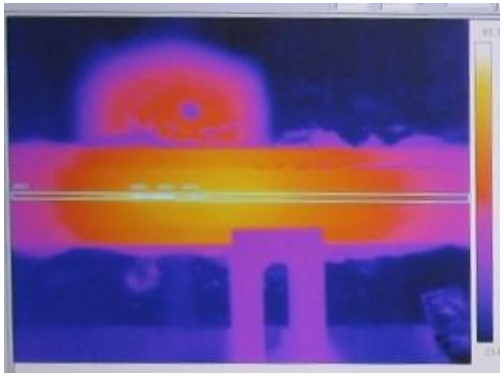


Production

- From design to product delivery
- Materials and packaging
- Thermal management
- Environmental tests



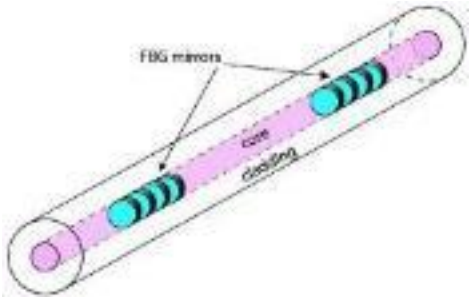




FBG- Fiber Bragg Grating
Collaboration with Prof. Ami Ishaaya

FBG –

A critical component used in fiber sensors - strain and temperature measurement.



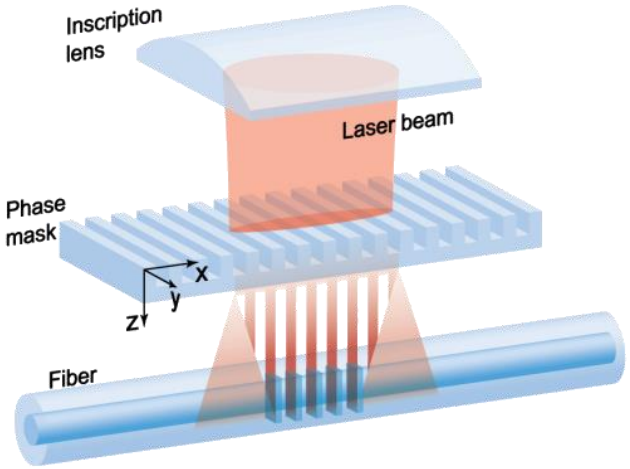
How does it work?

- An optical filtering device that reflects light on a specific wavelength
- Written by a laser within the core of an optical fiber.
- Wavelength dependence on temperature and strain

Fiber Bragg Gratings - FBG's

Motivation:

- Few commercial systems available on the market
- Limited number of providers of high-power or specialty fiber gratings components
- Extensive demand in the industry

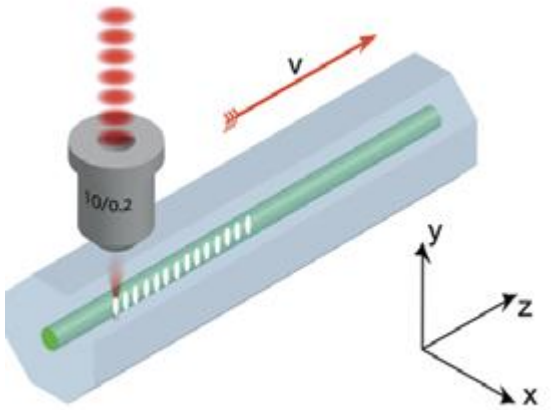


Fields of applications:

- Fiber lasers
- Telecommunication
- optical signal processing
- Sensing: Temperature, strain, pressure and vibration measurements- Wind Turbine, Well and Pipeline Monitoring, Smart Structures, Exhaust Control, Aerospace, Distributed Temperature Sensing (DTS)

Fiber Bragg Gratings - FBG's

- Writing Methods
  Draw Tower Gratings
- UV Excimer laser
- Femtosecond (FS) laser
- Writing through masks or point by point
  \Line by line



FS Advantages

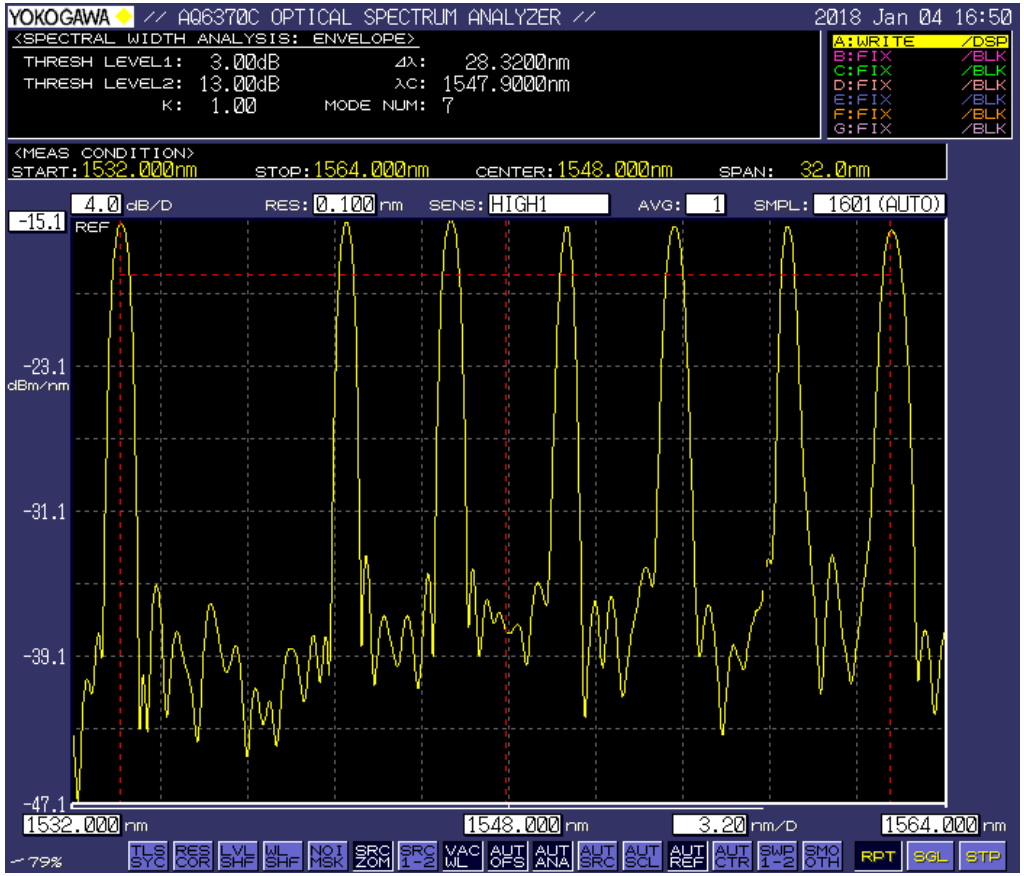
✓ Writing through the fiber coating
  Single-step process - No damage or time consuming
✓ Offers flexibility - Non-photosensitive glasses (Ge doped, Hydrogen)
✓ Enables inscription of FBGs and waveguides in the cladding of the fiber
✓ Immune to humidity and
✓ High temperature stability up to 1000°C

Israel Center for Advanced Photonics
המרכז הישראלי לפוטוניקה מתקדמת

SOREQ

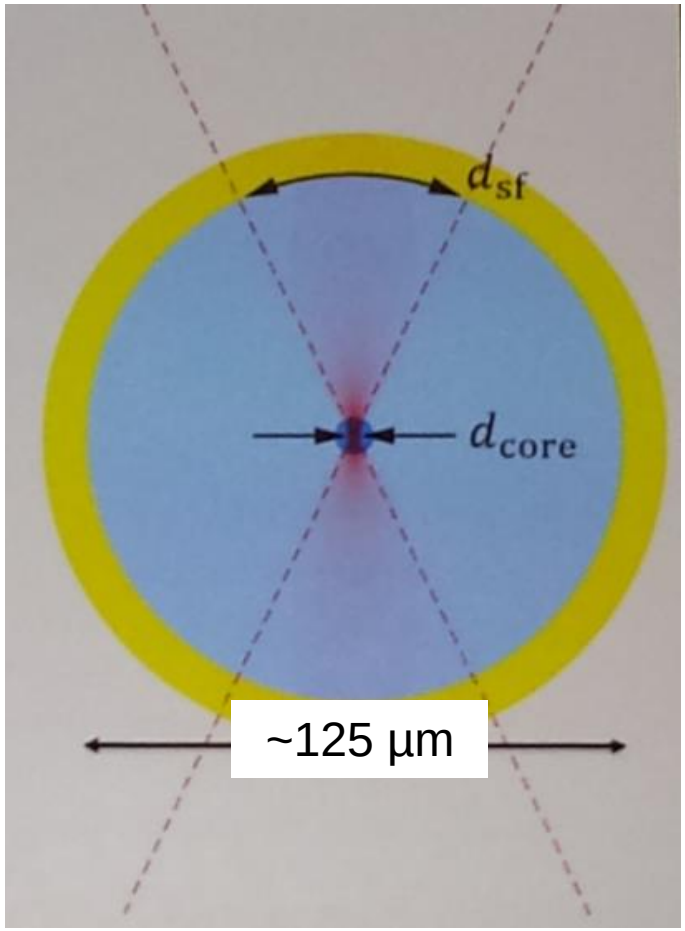
The infrastructure and knowledge of the Photonics Center - The right solution to industry needs

Reflection of 7 gratings (SMF-28 fiber)



- No splicing
- Polymide coating

FBG writing through the coating



- Requirements:
  - Power density in the fiber core - Above threshold of index change.
  - Power density in the polymer – Below damage threshold.