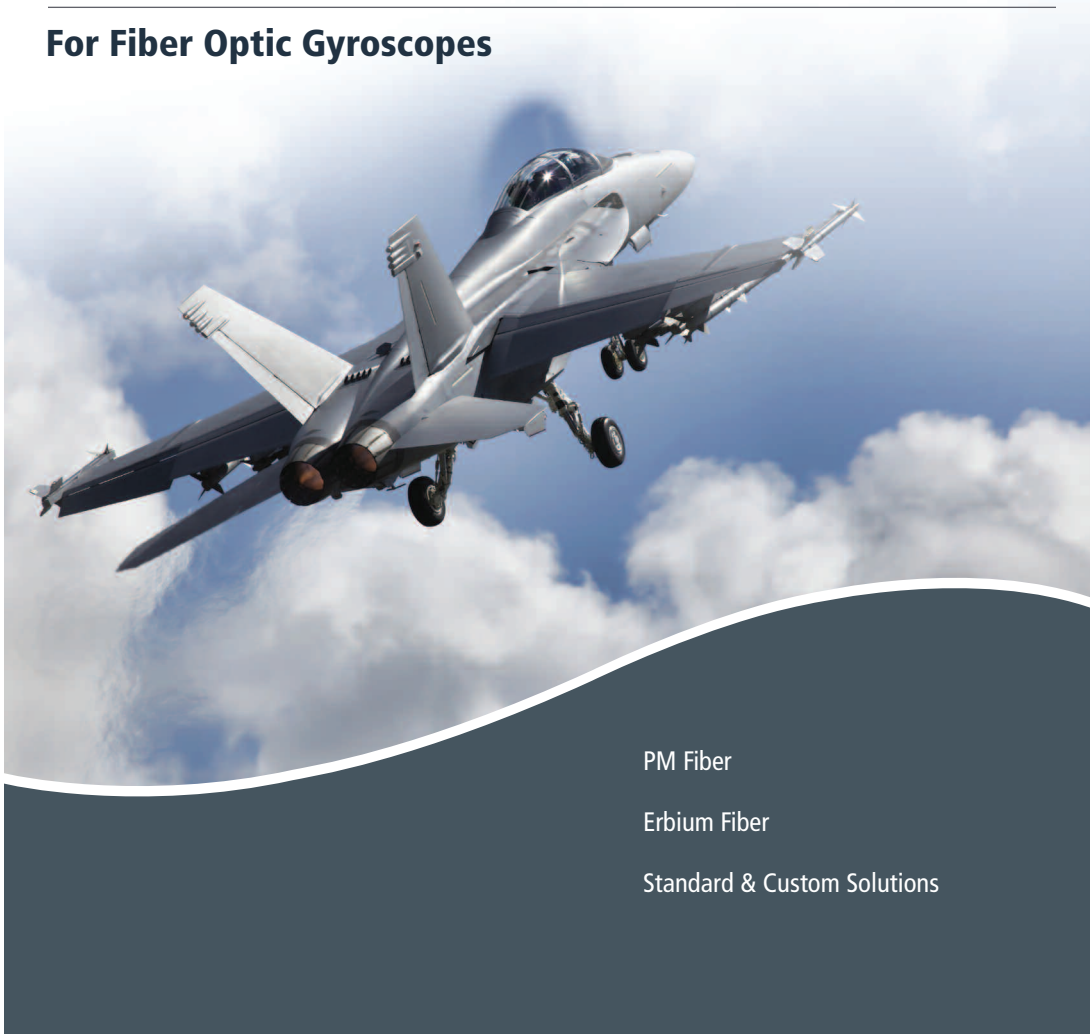




Specialty Photonics Division  
**Your Optical Fiber Solutions Partner**

# GyroSil™ PM Sensing Fibers

**For Fiber Optic Gyroscopes**



PM Fiber

Erbium Fiber

Standard & Custom Solutions

## Introduction

OFS Specialty Photonics Division is an industry leader in optical fiber design or modification for highly customized applications. It develops focused optical fiber solutions — the right fibers, cables, and other specialty optical fiber products — to meet the needs of established and growing industries.

GyroSil™ Polarization Maintaining Sensing Fibers (PM) are reduced diameter, dual stress rod fibers designed for use in fiber optic gyroscopes where long lengths and small diameter coils are a requirement. OFS has been manufacturing polarization maintaining fibers since 2001 when TruePhase® PM fibers were introduced for telecommunications applications. Also highlighted in this brochure are standard OFS erbium fibers suitable for gyroscope ASE sources.

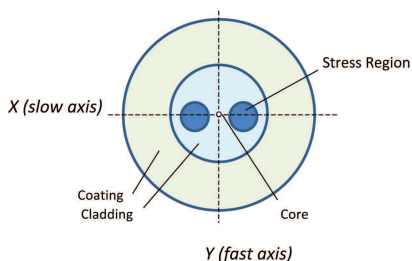
## Next Generation PM Designs

For next generation / enhanced performance gyroscopes, OFS Labs has broad capabilities in the area of fiber modeling, design and fabrication. Our R & D team will work with you to create fiber designs/prototypes that will bring you to the next level of performance. Once a prototype is approved, the design can be rapidly transferred to manufacturing at one of our three OFS Specialty Photonics Division sites.

## Polarization Maintaining (PM) Fiber

PM fibers are designed to have two distinct axes that each guide light at a different speed due to slightly different refractive indices. This “birefringence” is induced by building a significant degree of non-symmetrical stress in the fiber core. Non-PM fiber has a slight amount of birefringence caused by small geometrical asymmetries, bending or temperature changes. The larger stresses built into a PM fiber allow linearly polarized light which is launched into only one of the axes (either slow or fast), to be guided with negligible cross coupling to the opposing axis. Applications enabled by PM fiber include interferometry, modulators, and fiber optic sensors such as gyroscopes.

Dual Stress Rod Polarization Maintaining Fiber



## Characteristics of PM Fiber

The birefringence and crosstalk performance of a PM fiber is measured through these parameters:

- h-parameter – measures the degree to which the fiber maintains a linear polarization state - Amount of crosstalk per unit length  $h = \tanh^{-1} (P_y/P_x) / L$ , where  $P_x$  is power exiting launched axis and  $P_y$  is power exiting opposing axis

(example:  $10^{-5}/m$ )

- Beat length – the length over which the phase difference between the 2 axes differs by  $2\pi$  -Typical values are 2 mm to 5 mm (the shorter the beat length, the greater the birefringence)

## GyroSil Polarization Maintaining Sensing Fiber

In addition to high birefringence and low h-parameter, GyroSil PM sensing fibers have high numerical aperture, for excellent bend performance in small diameter coils. The dual acrylate coating system provides a soft inner layer to cushion the fiber during bend and a harder outer layer to protect against abrasion and other environmental contaminants.

A new proprietary processing method allows us to manufacture up to 150 kilometers from a single preform with high reliability and uniformity. Our stringent standards ensure small lot-to-lot variation between preform draws.

## Value-add Products

### Erbium

Gyroscope designs may include the use of erbium fiber as the gyroscope’s ASE source. OFS HG 980-80 and RE 120101-80 are 80  $\mu m$  reduced diameter fibers with high NA and moderate erbium concentration. HG 980 is available in a rad-hard version as a custom product.

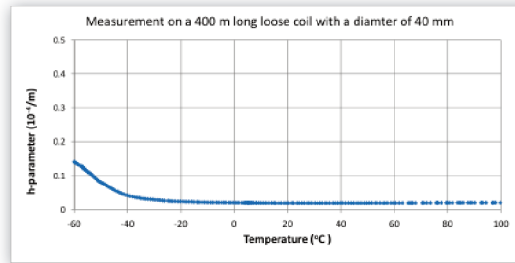
The OFS OASIX® Software package provides an accurate prediction of EDFA performance at all pump powers for the specific lot of EDF purchased.

### Bragg Gratings

Pump diodes used to pump the erbium ASE source benefit from the addition of stabilizer gratings. OFS can manufacture these filters in PM fiber to your custom specification.

## GyroSil™ PM Fibers

H-Parameter performance  
of GyroSil 1550 – 155  
over temperature range  
of -60 to 100° C



		GyroSil 1550-155	GyroSil 1550-135		GyroSil 840 - 170
<b>Optical Properties</b>				<b>Optical Properties</b>	
Center operating wavelength	nm	1550	1550	Center operating wavelength	840
Cut-off wavelength	nm	<1500	<1500	Cut-off wavelength	<800
Mode field diameter @ 1550 nm	µm	6.4 +/- 0.5	6.4 +/- 0.5	Mode field diameter @ 840 nm	4.3 +/- 1.0
Attenuation @ 1550 nm	dB/km	<1.0	<1.0	Attenuation @ 840 nm	<4.0
<b>PM properties</b>				<b>PM properties</b>	
h-parameter, shipping spool at room temperature	1/m	< 2 x 10 <sup>-5</sup>	< 2 x 10 <sup>-5</sup>	h-parameter, shipping spool at room temperature	< 2 x 10 <sup>-5</sup>
Beat length @ 1550 nm	mm	< 3.5	< 3.5	Beat length @ 840 nm	< 2.5
<b>Geometrical</b>				<b>Geometrical</b>	
Cladding diameter	µm	80 +/- 1	80 +/- 1	Cladding diameter	80 +/- 1
Coating diameter	µm	155 +/- 5	135 +/- 5	Coating diameter	170 +/- 5
Core concentricity error	µm	<0.5	<0.5	Core concentricity error	< 0.5
Proof test level	kpsi	100	100	Proof test level	100

## OFS Offers Two Erbium-Doped Fibers for ASE Source Applications

OFS offers two erbium-doped fibers for ASE source applications with a high NA and moderate erbium concentration. The 80 µm clad allows for very tight bend radii without compromising device reliability. Both fibers feature high-power conversion efficiency with low back-scattering for ASE stability, excellent lot-to-lot uniformity, and low, consistent splice loss. OFS EDF products meet the most stringent standards for performance and reliability.



Compatible with OASIX® Software Package:

Accurate prediction of EDF performance is essential to applications design. OFS offers specialized OASIX Amplifier Simulation System Software, which allows the designer to predict EDFA performance at all pump powers for the specific lot of EDF purchased. OASIX is also available in a DLL version for compatibility with external optimization tools.

	RE120101 80	HG980 80
<b>Optical Properties</b>		
Peak absorption near @ 1530 nm	22 – 28 dB/m	17.5 ± 2.5 dB/m
Numerical aperture	0.31 ± 0.02	0.29 ± 0.02
Cutoff wavelength	900 – 1100 nm	875 ± 75 nm
Mode field diameter @ 1550 nm	3.6 – 4.8 µm	4.4 ± 0.8 µm
PMD	n/a	≤0.5 ps/m
Loss @ 1200 nm	≤25 dB/km	≤15 dB/km
<b>Physical Properties</b>		
Cladding diameter	80 ± 1 µm	80 ± 2 µm
Coating diameter	190 ± 15 µm	165 ± 10 µm
Core eccentricity	≤0.5 µm	≤0.3 µm
<b>Mechanical and Testing Data</b>		
Proof test level	2% (200 kpsi)	2% (200 kpsi)
Order by Part Number:	<b>RE120101 80</b>	<b>552 ERFB 009</b>
Typical Applications	ASE source applications • Small form-factor ASE sources • Pumping at either 980 or 1480 nm	

**Options:** Customized Spectral Shape, Tighter Optical Property Specifications, Coils, Custom Designs, HG980 80 also available in standard 125 µm cladding size with 250 µm coating.

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A Furukawa Company

SPECIALTY PHOTONICS DIVISION

55 Darling Drive  
Avon, CT 06001

Phone: 1 860 678 0371  
Toll Free: 1 888 438 9936  
Email: [Info@SpecialtyPhotonics.com](mailto:Info@SpecialtyPhotonics.com)  
Web: [www.SpecialtyPhotonics.com](http://www.SpecialtyPhotonics.com)

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 /OFS\_specialty    /ofsSpecialty

