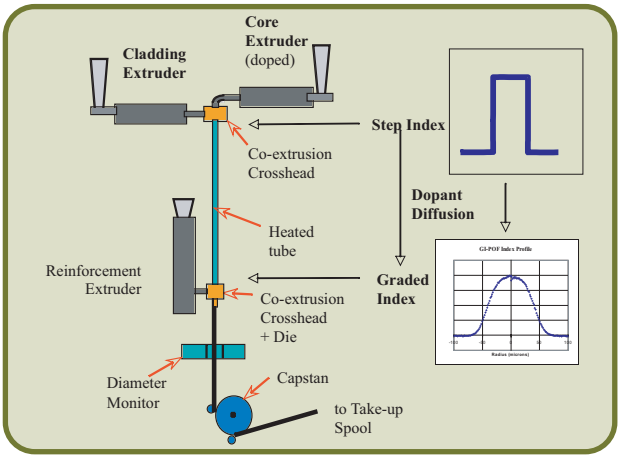
Graded-Index Polymer Optical Fiber (GI-POF)

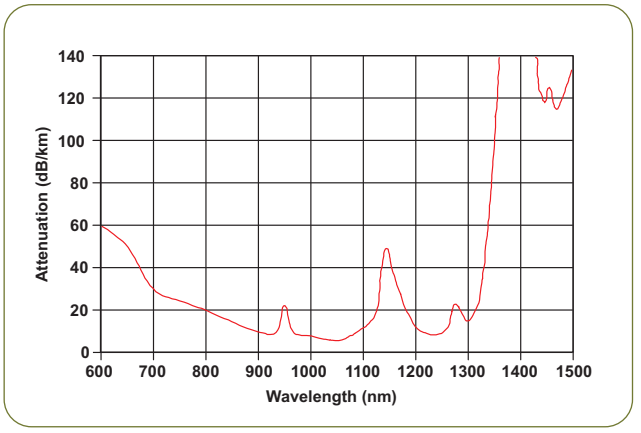
Perfluorinated graded-index polymer optical fibers (GI-POFs) combine high data transmission rates and low attenuation in the commercially desirable 850–1300nm range. GI-POFs offer a direct replacement and a low cost alternative to traditional glass. With ease of use and affordability, GI-POFs make an excellent choice for the installation of high performance fiber networks. In addition, GI-POFs provide a higher transmission bandwidth than any other type of plastic optical fiber.

Until recently, all commercially available POFs have been fabricated from non-fluorinated polymers such as polymethylmethacrylate (PMMA) and, as a result, have had a refractive index that changes in steps. Although inexpensive, these fibers are characterized by large modal dispersion and typically operate at 530nm or 650nm, which is well outside of standard communication wavelengths (850nm or 1300nm), which is where high-speed transceivers are readily available. Due to the high attenuation in the near infrared, these fibers are restricted to low performance (<100Mb/s), short range (<50m) applications in the visible region.

With the advent of an amorphous perfluorinated polymer, polyperfluoro-butenylvinylether (commercially known as CYTOP®), the limitations presented by step-index POFs have been overcome. Perfluorinated fiber exhibits very low attenuation in the near infrared (~10dB/km) as shown in the figure above and to the right and can support transmission rates up to 10Gb/s for distances up to 100m. Moreover, since the perfluorinated optical fiber can be constructed with a graded refractive index, it is capable of supporting bandwidths that are 100 times larger than those provided by conventional POFs. This is due to the interplay between high mode coupling, low material dispersion, and differential mode attenuation.



Unlike conventional glass fibers, which suffer from high interconnection and receiver costs, perfluorinated GI-POFs are easy to install. To add a connector to a glass fiber, the fiber needs to be cleaved using an expensive, specialized tool. Then, epoxy is used to attach the fiber to the connector hardware. Finally, the assembled connector must be polished. In contrast, the GI-POF can be terminated using simple and inexpensive tools, connectors are crimped on, and polishing occurs in mere seconds, leading to a high quality optical link in a fraction of the time. Moreover, GI-POFs are compatible with standard multimode glass fiber



transceivers.

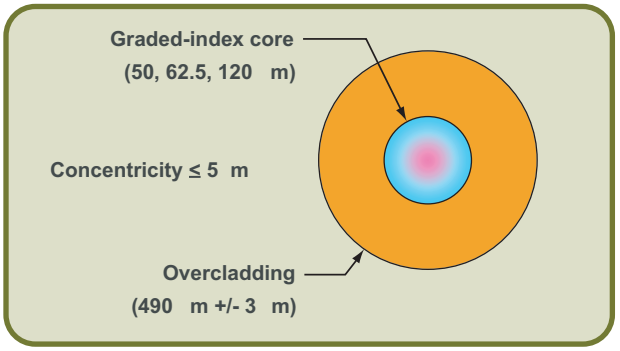
Next-Generation GI-POFs:

Thorlabs is pleased to offer a line of graded-index polymer optical fibers from Chromis Fiberoptics, a pioneer in plastic optical fiber technology and a world leader in perfluorinated GI-POFs. Unlike conventional preform-based manufacturing processes for GI-POFs, Chromis' patented manufacturing process extrudes fibers directly from bulk materials, resulting in high production rates at unmatched prices.

+ Cross-section of extruded perfluorinated GI-POF with an overclad (reinforcement) layer.

In order to produce GI-POFs with the properties necessary to meet the demands of high performance applications, two major hurdles needed to be overcome. First, a technique needed to be developed to produce a high-quality, graded-index structure consistently. Second, the high purity of the perfluorinated material needed to be maintained during the extrusion process so that attenuation levels below 30dB/m could be achieved.

Chromis' extrusion technology continuously converts high purity bulk materials into concentric layers of melt streams. As the melt streams are extruded into fiber, the concentric layers fuse to form the graded-index fiber. By controlling the temperature, residence times, and relative flow rates of the core and clad materials, fibers with a wide variety of dimensions and refractive index structures can be formed. By altering the polymer material used in the melt, specialty fibers, such as those used in high temperature or flame-retardant applications, can be produced using the same process.



Plastic Optical Fibers

Thorlabs now offers a line of graded-index polymer optical fibers (GI-POFs) from Chromis Fiberoptics. These multimode fibers offer low attenuation and low material dispersion, thus allowing for high-speed Gigabit Ethernet and multi-gigabit applications at distances up to 100 meters or Fast Ethernet up to 200 meters. These fibers feature the ease of use associated with plastic fibers while providing the low loss, low dispersion, and good transmission characteristics typical of glass fibers at 850nm and 1300nm. In addition, these fibers can sustain long-term bending radii that are as small as 5mm, which is much better than glass fibers of the same core size. GI-POF fiber is simple to terminate and the end face can be polished quickly to produce a low-loss connection. The GI-POF fibers do not require special adapters in order to mate them with like core sized glass equivalent devices. As a result, GI-POF fibers are a direct drop-in glass fiber replacement alternative with a significant cost advantage.

Product Specifications

	50SR	62SR	120SR
Transmission Characteristics			
Attenuation at 850nm	<60dB/km		
Attenuation at 1300nm	<60dB/km		
Bandwidth at 850nm	>300MHz-km		
Numerical Aperture	0.190 ± 0.015	0.190 ± 0.015	0.185 ± 0.015
Macrobend Loss1	<0.25dB	<0.35dB	<0.60dB
Zero Dispersion Wavelength	1200-1650nm		
Dispersion Slope	<0.06ps/nm2-km		
Physical Characteristics			
Core Diameter	50 ± 5µm	62.5 ± 5µm	120 ± 10µm
Cladding Diameter	490 ± 5µm		
Core-Cladding Concentricity	<4µm	<5µm	<5µm
Maximum Tensile Load	7.0N		
Bending Radius, Long Term	5mm	5mm	10mm
Environmental Performance			
Temperature Induced Attenuation at 850nm (-20 to +70°C)	<5dB/km		
Temperature Induced Attenuation at 850nm (75°C, 85% RH, 30 Day Cycle)	<10dB/km		

1) for 10 turns on a 25mm radius quarter circle

Plastic Optical Fiber

ITEM#	$	£	€	RMB	CORE SIZE	DESCRIPTION
GIPOF50	$ 1.26	£ 0.79	€ 1,17	¥ 12.03	50µm	GI-POF, Price per Meter
GIPOF62	$ 1.48	£ 0.93	€ 1,38	¥ 14.13	62.5µm	GI-POF, Price per Meter
GIPOF120	$ 1.82	£ 1.15	€ 1,69	¥ 17.38	120µm	GI-POF, Price per Meter

Jacketed Plastic Optical Fiber

ITEM#	$	£	€	RMB	CORE SIZE	DESCRIPTION
GIPOF50-P	$ 1.74	£ 1.10	€ 1,62	¥ 16.62	50µm Core	GI-POF, Plenum Cable Jacket, Price per Meter
GIPOF62-P	$ 1.96	£ 1.23	€ 1,82	¥ 18.72	62.5µm Core	GI-POF, Plenum Cable Jacket, Price per Meter
GIPOF120-P	$ 2.30	£ 1.45	€ 2,14	¥ 21.97	120µm Core	GI-POF, Plenum Cable Jacket, Price per Meter