56 Sparta Avenue • Newton, New Jersey 07860
(973) 300-3000 Sales • (973) 300-3600 Fax
www.thorlabs.com

THORLABS

ER80-4/125 - May 21, 2015

Item # ER80-4/125 was discontinued on May 21, 2015. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

ERBIUM DOPED SM AND LMA OPTICAL FIBER

- ▶ Erbium-Doped Fiber for Fiber Amplifiers and Lasers
- ▶ 1530 - 1610 Emission (C & L Bands)
- ▶ 980 nm and 1480 nm Pump Wavelengths
- ▶ Core-Pumped Single Mode or Large Mode Area Fibers Available

M5-980-125

ER30-4/125

OVERVIEW

Features

- Er-Doped Optical Fiber for Emission in the 1530 - 1610 nm Wavelength Range
- Core-Pumped Single Mode and Large-Mode-Area Fibers Available
- Industry Standard Ø125 µm Cladding for Easy Handling, Splicing, and Termination

Thorlabs offers two lines of Erbium-doped active optical fibers. Liekki™ Er-doped fibers are single mode (SM) and large-mode-area (LMA) fibers for use with pump wavelengths of 980 nm or 1480 nm and emissions in the C and L telecommunications bands (1530 - 1565 nm or 1565 - 1625 nm, respectively). MetroGain™ Er-doped single mode fibers are also designed for emission in either the C or L band and have high dopant concentrations for short device lengths.

Item #	Type	Peak Core Absorption	Pump Type	MFD (at 1550 nm)	Cladding Diameter
ER30-4/125	SM[a]	30 ± 3 dB/m[c]	Core	6.5 ± 0.5 µm	125 ± 2 µm
ER80-4/125		80 ± 8 dB/m[c]			
ER110-4/125		110 ± 10 dB/m[c]			
ER16-8/125	LMA[b]	16 ± 3 dB/m[c]		9.5 ± 0.8 µm	
ER80-8/125		8 ± 8 dB/m[c]			
M5-980-125	SM[a]	4.5 - 5.5 dB/m[d] 5.4 - 7.1 dB/m[e]		5.5 - 6.3 µm	125 ± 1 µm
M12-980-125		11.0 - 13.0 dB/m[d] 16.0 - 20.0 dB/m[e]		5.7 - 6.6 µm	

- Single Mode
- Large Mode Area
- Measured at 1530 nm
- Measured at 980 nm
- Measured at 1531 nm

Active Fibers Selection Guide					
Ytterbium-Doped SM and LMA	Ytterbium-Doped PM	Erbium-Doped SM and LMA	Thulium-Doped SM and LMA	Thulium-Doped PM	Doped Fluoride Fibers for MIR

SPECS

Liekki Erbium-Doped SM and LMA Active Fibers

Item #	ER30-4/125	ER80-4/125	ER110-4/125	ER16-8/125	ER80-8/125
Peak Core Absorption @ 1530 nm	30 ± 3 dB/m	80 ± 8 dB/m	110 ± 10 dB/m	16 ± 3 dB/m	8 ± 8 dB/m
MFD	6.5 ± 0.5 µm	6.5 ± 0.5 µm	6.5 ± 0.5 µm	9.5 ± 0.8 µm	9.5 ± 0.8 µm
Numerical Aperture (NA, Nominal)	0.2	0.2	0.2	0.13	0.13
Cut-Off Wavelength	800 - 980 nm	800 - 980 nm	800 - 980 nm	1100 - 1400 nm	1100 - 1400 nm
Cladding Diameter	125 ± 2 µm	125 ± 2 µm	125 ± 2 µm	125 ± 2 µm	125 ± 2 µm
Cladding Geometry	Round	Round	Round	Round	Round
Coating (Second Cladding) Diameter	245 ± 15 µm	245 ± 15 µm	245 ± 15 µm	245 ± 15 µm	245 ± 15 µm
Coating Material	High Index Acrylate	High Index Acrylate	High Index Acrylate	High Index Acrylate	High Index Acrylate
Core Concentricity Error	<0.7 µm	<0.7 µm	<0.7 µm	<0.7 µm	<0.7 µm
Proof Test	>1%	>1%	>1%	>100 kpsi	>1%
Core Index	Proprietary[a]				
Cladding Index	Proprietary[a]				

- We regret that we cannot provide this proprietary information.

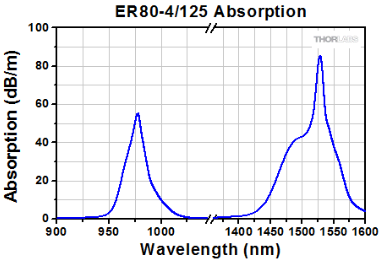
Fibercore MetroGain Erbium-Doped SM Active Fibers

Item #	M5-980-125	M12-980-125
MFD (Nominal)	5.5 - 6.3 µm at 1550 nm	5.7 - 6.6 µm at 1550 nm
Emission Wavelength	C-Band (1530 - 1565 nm)	L-Band (1565 - 1625 nm)
Core Absorption @ 980 nm	4.5 - 5.5 dB/m	11.0 - 13.0 dB/m
Core Absorption @ 1531 nm	5.4 - 7.1 dB/m	16.0 - 20.0 dB/m
Core Numerical Aperture (NA, Nominal)	0.21 - 0.24	0.21 - 0.24
Cut-Off Wavelength	900 - 970 nm	900 - 970 nm
Cladding Diameter	125 ± 1 µm	125 ± 1 µm
Cladding Geometry	Round	Round
Coating Diameter (Nominal)	245 ± 15 µm	245 ± 15 µm
Coating Material	Dual Acrylate	Dual Acrylate
Background Loss	<10 dB/km	<20 dB/km
Core Concentricity Error	≤0.5 µm	≤0.5 µm
Proof Test	1% (100 kpsi)	
Core Index	Proprietary[a]	
Cladding Index	Proprietary[a]	

- We regret that we cannot provide this proprietary information.

ABSORPTION GRAPHS

Erbium Doped Fiber Absorption Graphs



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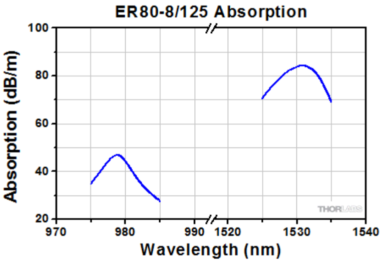

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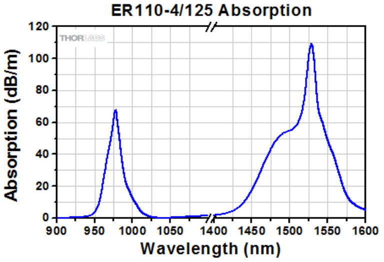

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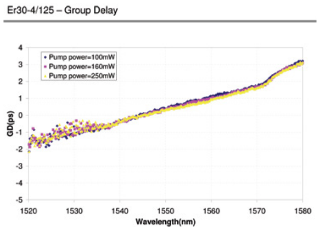
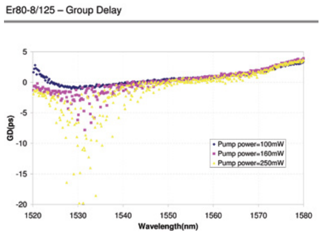
DISPERSION GRAPHS

Group Delay

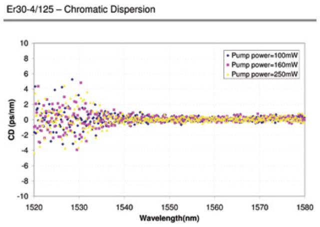
Below is the plot of group delay (GD) as a function of wavelength for three different pump powers for ER30-4/125 and ER80-8/125 Erbium-doped fiber. Group delay is the time required for information in a signal (i.e., any specific point on the modulation waveform) to travel the length of the optical path.

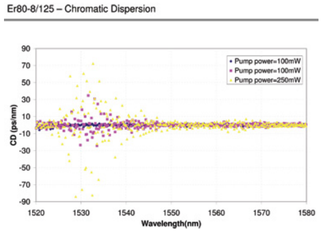




Chromatic Dispersion

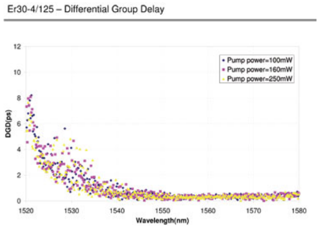
Below is the plot of chromatic dispersion (CD) as a function of wavelength for three different pump powers for ER30-4/125 and ER80-8/125 Erbium-doped fibers. Chromatic dispersion is simply the local slope of the group delay versus wavelength graph.

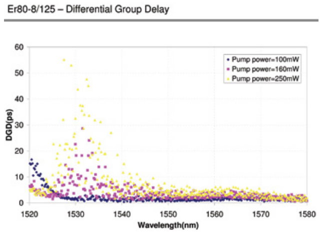




Differential Group Delay

Below is the plot of differential group delay (DGD) as a function of wavelength for three different pump powers for ER30-4/125 and ER80-8/125 Erbium-doped fiber. Differential group delay is defined as the maximum group delay variation over all polarization states.





PUBLICATIONS

Active Optical Fiber Publications and Further Reading

As an emerging field of research, many advancements in doped fiber laser and amplifier construction are being made. The following publications contain information that may be helpful in the construction of fiber lasers and amplifiers.

2012

Bryce Samson, George Oulundsen, Adrian Carter, and Steven R. Bowman, "OPTICAL FIBER FABRICATION: Holmium-doped silica fiber designs extend fiber lasers beyond 2 µm," Laser Focus World, August 1, 2012

2011

Jianwu Ding, Bryce Samson, Adrian Carter, Chiachi Wang, Kanishka Tankala, "A Monolithic Thulium Doped Single Mode Fiber Laser with 1.5ns Pulsewidth and 8kW Peak Power," Proc. SPIE 7914, Fiber Lasers VIII: Technology, Systems, and Applications, 79140X (February 10, 2011); doi:10.1117/12.876867

2010

Timothy S. McComb, Pankaj Kadwani, R. Andrew Sims, Lawrence Shah, Christina C. C. Willis, Gavin Frith, Vikas Sudesh, Bryce Samson, Martin Richardson, "Amplification of Picosecond Pulses Generated in a Carbon Nanotube Modelocked Thulium Fiber Laser," in *Lasers, Sources and Related Photonic Devices*, OSA Technical Digest Series (CD) (Optical Society of America, 2010), paper AMB10.

G. Frith, A. Carter, B. Samson, J. Faroni, K Farley, K Tankala and G. E. Town, "Mitigation of photodegradation in 790nm-pumped Tm-doped fibers," *Proc. SPIE* 7580, Fiber Lasers VII: Technology, Systems, and Applications, 75800A (February 17, 2010); doi:10.1117/12.846230

Thomas Ehrenreich, Ryan Laveille, Imtiaz Majid, and Kanishka Tankala, Glen Rines, Peter Moulton "1-kW All-Glass Tm:fiber Laser," SPIE Photonics West 2010: LASE Presentation, Session 16: Late-Breaking News, January 29, 2010

2009

Gavin Frith, Adrian Carter, Bryce Samson, and Graham Town, "Design considerations for short-wavelength operation of 790-nm-pumped Tm-doped fibers," Appl. Opt. **48**, 5072-5075 (2009)

S.D. Jackson, "The spectroscopic and energy transfer characteristics of the rare earth ions used fr silicate glass fibre lasers operating in the shortwave infrared," Laser & Photon. Rev., 3: 466–482. doi: 10.1002/lpor.200810058

Peter F. Moulton, Glen A. Rines, Evgueni V. Slobodtchikov, Kevin F. Wall, Gavin Frith, Bryce Samson, and Adrian L.G. Carter, "Tm-Doped Fiber Lasers: Fundamentals and Power Scaling," IEEE Journal of Selected Topics in quantum Electronics, Vol. 15, No. 1, Jan/Feb 2009

2006

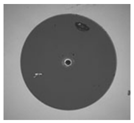
Alexander Hemming, Shayne Bennetts, Nikita Simakov , John Haub, Adrian Carter, "Development of resonantly cladding-pumped holmium-doped fibre lasers," *Proc. SPIE* 8237, Fiber Lasers IX: Technology, Systems, and Applications, 82371J (February 9, 2012); doi:10.1117/12.909458

W. Torruellas, Y. Chen, B. McIntosh, J. Farroni, K. Tankala, S. Webster, D. Hagan, M. J. Soileau, M. Messerly, J. Dawson, "High peak power Ytterbium doped fiber amplifiers," *Proc. SPIE* 6102, Fiber Lasers III: Technology, Systems, and Applications, 61020N (February 23, 2006); doi:10.1117/12.646571

DAMAGE THRESHOLD

Laser Induced Damage in Optical Fibers

The following tutorial details damage mechanisms in unterminated (bare) and terminated optical fibers, including damage mechanisms at both the air-to-glass interface and within the glass of the optical fiber. Please note that while general rules and scaling relations can be defined, absolute damage thresholds in optical fibers are extremely application dependent and user specific. This tutorial should only be used as a guide to estimate the damage threshold of an optical fiber in a given application. Additionally, all calculations below only apply if all cleaning and use recommendations listed in the last section of this tutorial have been followed. For further discussion about an optical fiber's power handling abilities within a specific application, contact Thorlabs' Tech Support.


Click to Enlarge
Damaged Fiber End


Click to Enlarge
Undamaged Fiber End

Damage at the Free Space-to-Fiber Interface

There are several potential damage mechanisms that can occur at the free space-to-fiber interface when coupling light into a fiber. These come into play whether the fiber is used bare or terminated in a connector.

Unterminated (Bare) Fiber

Damage mechanisms in bare optical fiber can be modeled similarly to bulk optics, and industry-standard damage thresholds for UV Fused Silica substrates can be applied to silica-based fiber (refer to the table to the right). The surface areas and beam diameters involved at the air-to-glass interface are extremely small compared to bulk optics, especially with single mode (SM) fiber, resulting in very small damage thresholds.

Untermiated Silica Fiber Maximum Power Densities

Type	Theoretical Damage Threshold	Practical Safe Value
CW (Average Power)	1 MW/cm^2	250 kW/cm^2
10 ns Pulsed (Peak Power)	5 GW/cm^2	1 GW/cm^2

The effective area for SM fiber is defined by the mode field diameter (MFD), which is the effective cross-sectional area through which light propagates in the fiber. A free-space beam of light must be focused down to a spot of roughly 80% of this diameter to be coupled into the fiber with good efficiency. MFD increases roughly linearly with wavelength, which yields a roughly quadratic increase in damage threshold with wavelength. Additionally, a beam coupled into SM fiber typically has a Gaussian-like profile, resulting in a higher power density at the center of the beam compared with the edges, so a safety margin must be built into the calculated damage threshold value if the calculations assume a uniform density.

Multimode (MM) fiber's effective area is defined by the core diameter, which is typically far larger than the MFD in SM fiber. Kilowatts of power can be typically coupled into multimode fiber without damage, due to the larger core size and the resulting reduced power density.

It is typically uncommon to use single mode fibers for pulsed applications with high per-pulse powers because the beam needs to be focused down to a very small area for coupling, resulting in a very high power density. It is also uncommon to use SM fiber with ultraviolet light because the MFD becomes extremely small; thus, power handling becomes very low, and coupling becomes very difficult.

Example Calculation

For SM400 single mode fiber operating at 400 nm with CW light, the mode field diameter (MFD) is approximately Ø3 µm. For good coupling efficiency, 80% of the MFD is typically filled with light. This yields an effective diameter of Ø2.4 µm and an effective area of 4.52 μm^2:

$$\text{Area} = \pi r^2 = \pi(\text{MFD}/2)^2 = \pi \bullet 1.2^2\ \mu m^2 = 4.52\ \mu m^2$$

This can be extrapolated to a damage threshold of 11.3 mW. We recommend using the "practical value" maximum power density from the table above to account for a Gaussian power distribution, possible coupling misalignment, and contaminants or imperfections on the fiber end face:

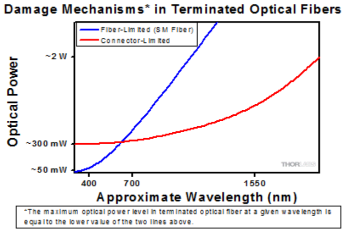
$$250\ \text{kW/cm}^2 = 2.5\ \text{mW/}\mu m^2$$

$$4.25\ \mu m^2 \bullet 2.5\ \text{mW/}\mu m^2 = 11.3\ \text{mW}$$

Terminated Fiber

Optical fiber that is terminated in a connector has additional power handling considerations. Fiber is typically terminated by being epoxied into a ceramic or steel ferrule, which forms the interfacing surface of the connector. When light is coupled into the fiber, light that does not enter the core and propagate down the fiber is scattered into the outer layers of the fiber, inside the ferrule.

The scattered light propagates into the epoxy that holds the fiber in the ferrule. If the light is intense enough, it can melt the epoxy, causing it to run onto the face of the connector and into the beam path. The epoxy can be burned off, leaving residue on the end of the fiber, which reduces coupling efficiency and increases scattering, causing further damage. The lack of epoxy between the fiber and ferrule can also cause the fiber to be decentered, which reduces the coupling efficiency and further increases scattering and damage.



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The power handling of terminated optical fiber scales with wavelength for two reasons. First, the higher per photon energy of short-wavelength light leads to a greater likelihood of scattering, which increases the optical power incident on the epoxy near the end of the connector. Second, shorter-wavelength light is inherently more difficult to couple into SM fiber due to the smaller MFD, as discussed above. The greater likelihood of light not entering the fiber's core again increases the chance of damaging scattering effects. This second effect is not as common with MM fibers because their larger core sizes allow easier coupling in general, including with short-wavelength light.

Fiber connectors can be constructed to have an epoxy-free air gap between the optical fiber and ferrule near the fiber end face. This design feature, commonly used with multimode fiber, allows some of the connector-related damage mechanisms to be avoided. Our high-power multimode fiber patch cables use connectors with this design feature.

Combined Damage Thresholds

As a general guideline, for short-wavelength light at around 400 nm, scattering within connectors typically limits the power handling of optical fiber to about 300 mW. Note that this limit is higher than the limit set by the optical power density at the fiber tip. However, power handing limitations due to connector effects do not diminish as rapidly with wavelength when compared to power density effects. Thus, a terminated fiber's power handling is "connector-limited" at wavelengths above approximately 600 nm and is "fiber-limited" at lower wavelengths.

The graph to the right shows the power handling limitations imposed by the fiber itself and a surrounding connector. The total power handling of a terminated fiber at a given wavelength is limited by the lower of the two limitations at that wavelength. The fiber-limited (blue) line is for SM fibers. An equivalent line for multimode fiber would be far above the SM line on the Y-axis. For terminated multimode fibers, the connector-limited (red) line always determines the damage threshold.

Please note that the values in this graph are rough guidelines detailing estimates of power levels where damage is very unlikely with proper handling and alignment procedures. It is worth noting that optical fibers are frequently used at power levels above those described here. However, damage is likely in these applications. The optical fiber should be considered a consumable lab supply if used at power levels above those recommended by Thorlabs.

Damage Within Optical Fibers

In addition to damage mechanisms at the air-to-glass interface, optical fibers also display power handling limitations due to damage mechanisms within the optical fiber itself. Two categories of damage within the fiber are damage from bend losses and damage from photodarkening.

Bend Losses

Bend losses occur when a fiber is bent to a point where light traveling in the core is incident on the core/cladding interface at an angle higher than the critical angle, making total internal reflection impossible.Under these circumstances, light escapes the fiber, often in one localized area. The light escaping the fiber typically has a high power density, which can cause burns to the fiber as well as any surrounding furcation tubing.

A special category of optical fiber, called double-clad fiber, can reduce the risk of bend-loss damage by allowing the fiber's cladding (2nd layer) to also function as a waveguide in addition to the core. By making the critical angle of the cladding/coating interface higher than the critical angle of the core/clad interface, light that escapes the core is loosely confined within the cladding. It will then leak out over a distance of centimeters or meters instead of at one localized spot within the fiber, minimizing damage. Thorlabs manufactures and sells 0.22 NA double-clad multimode fiber, which boasts very high, megawatt range power handling.

Photodarkening
A second damage mechanism within optical fiber, called photodarkening or solarization, typically occurs over time in fibers used with ultraviolet or short-wavelength visible light. The pure silica core of standard multimode optical fiber can transmit ultraviolet light, but the attenuation at these short wavelengths increases with the time exposed to the light. The mechanism that causes photodarkening is largely unknown, but several strategies have been developed to combat it. Fibers with a very low hydroxyl ion (OH) content have been found to resist photodarkening. Other dopants, including fluorine, can also reduce photodarkening.

Germanium-doped silica, which is commonly used for the core of single mode fiber for red or IR wavelengths, can experience photodarkening with blue visible light. Thus, pure silica core single mode fibers are typically used with short wavelength visible light. Single mode fibers are typically not used with UV light due to the small MFD at these wavelengths, which makes coupling extremely difficult.

Even with the above strategies in place, all fibers eventually experience photodarkening when used with UV light, and thus, fibers used with these wavelengths should be considered consumables.

Tips for Maximizing an Optical Fiber's Power Handling Capability

With a clear understanding of the power-limiting mechanisms of an optical fiber, strategies can be implemented to increase a fiber’s power handling capability and reduce the risk of damage in a given application. All of the calculations above only apply if the following strategies are implemented.

One of the most important aspects of a fiber’s power-handling capability is the quality of the end face. The end face should be clean and clear of dirt and other contaminants that can cause scattering of coupled light. Additionally, if working with bare fiber, the end of the fiber should have a good quality cleave, and any splices should be of good quality to prevent scattering at interfaces.

The alignment process for coupling light into optical fiber is also important to avoid damage to the fiber. During alignment, before optimum coupling is achieved, light may be easily focused onto parts of the fiber other than the core. If a high power beam is focused on the cladding or other parts of the fiber, scattering can occur, causing damage.

Additionally, terminated fibers should not be plugged in or unplugged while the light source is on, again so that focused beams of light are not incident on fragile parts of the connector, possibly causing damage.

Bend losses, discussed above, can cause localized burning in an optical fiber when a large amount of light escapes the fiber in a small area. Fibers carrying large amounts of light should be secured to a steady surface along their entire length to avoid being disturbed or bent.

Additionally, choosing an appropriate optical fiber for a given application can help to avoid damage. Large-mode-area fibers are a good alternative to standard single mode fibers in high-power applications. They provide good beam quality with a larger MFD, thereby decreasing power densities. Standard single mode fibers are also not generally used for ultraviolet applications or high-peak-power pulsed applications due to the high spatial power densities these applications present.

Liekki™ Er-Doped SM and LMA Fibers

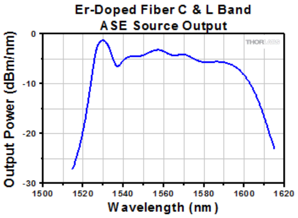
- For Emission from 1530 to 1610 nm with 980 nm and 1480 nm Pump Sources
- Geometric Properties Provide Very Low Birefringence and Excellent Splice Characteristics
- Typical Splice Loss to SM Fiber of Pump Laser: <0.1 dB
- Typical Splice Loss to SMF-28e+ Fiber: <0.15 dB

Key Features	
ER30-4/125	Extremely high, >50% conversion efficiency in the L band
ER80-4/125	High doping concentration for short device length and reduced nonlinearity
ER110-4/125	Extremely high doping concentration for short device length and reduced nonlinearity
ER16-8/125	Good spliceability, power conversion efficiency, and spectral reproducibility
ER80-8/125	For 980 nm pumps with emission at 1550 nm. Large core and good spliceability.

Applications

- C- and L-Band DWDM, Metro, CATV, and PON
- ASE Sources
- CW and Pulsed Lasers and Amplifiers

Liekki highly doped erbium fibers are suitable for fiber lasers and amplifiers operating in the 1530 to 1610 nm wavelength region (C and L bands). These fibers cover broad application fields ranging from telecommunication amplifiers (EDFAs) to high-power PON/CATV boosters and ultra-short pulse amplifiers used in instrumentation, industrial, and medical applications. These highly doped fibers have a standard Ø125 µm cladding.



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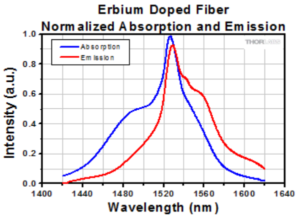

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Cladding-pumped, double-clad large-mode-area (LMA) erbium fibers are also available upon request. Contact techsupport@thorlabs.com

Item #	Type	Peak Core Absorption at 1530 nm	Mode Field Diameter at 1550 nm	Cladding Diameter	Coating Diameter	Core NA (Nominal)	Cut-Off Wavelength	Core Index	Cladding Index
ER30-4/125	Single Mode	30 ± 3 dB/m	6.5 ± 0.5 µm	125 ± 2 µm	245 ± 15 µm	0.2	800 - 980 nm	Proprietary[a]	Proprietary[a]
ER80-4/125		80 ± 8 dB/m							
ER110-4/125		110 ± 10 dB/m							
ER16-8/125	Large Mode Area	16 ± 3 dB/m	9.5 ± 0.8 µm			0.13	1100 - 1400 nm		
ER80-8/125		80 ± 8 dB/m							

- We regret that we cannot provide this proprietary information.

Part Number	Description	Price	Availability
ER30-4/125	**Erbium Doped Fiber, 30 dB/m @ 1530 nm, 0.2 NA, Standard**	**$22.75 Per Meter Volume Pricing Available**	**Today**
ER80-4/125	**Erbium Doped Fiber, 80 dB/m @ 1530 nm, 0.2 NA, Experimental**	**$100.98 Per Meter Volume Pricing Available**	**Lead Time**
ER110-4/125	**Erbium Doped Fiber, 110 dB/m @ 1530 nm, 0.2 NA, Experimental**	**$100.98 Per Meter Volume Pricing Available**	**Today**
ER16-8/125	**Erbium Doped Fiber, 16 dB/m @ 1530 nm, 0.13 NA, Experimental**	**$77.32 Per Meter Volume Pricing Available**	**Today**
ER80-8/125	**Erbium Doped Fiber, 80 dB/m @ 1530 nm, 0.13 NA, Experimental**	**$100.98 Per Meter Volume Pricing Available**	**Today**

MetroGain™ Er-Doped SM Fibers

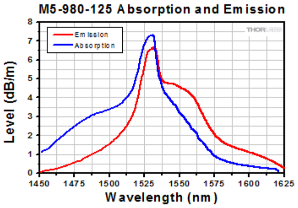
- For 980 nm and 1480 nm Pump Sources with Emission in the C or L Band (1530 - 1565 nm or 1565 - 1625 nm)
- High Absorption for Short Gain Sections or Laser Cavities

Applications

- C- and L-Band Fiber Amplifiers
- ASE Sources

MetroGain Erbium-doped fibers are optimized for emission in the C and L telecommunications bands. M5-980-125 fiber is effective for high-power C-Band use (1530 - 1565 nm) when pumped at 1480 nm. M12-980-125 fiber is optimized for L-band emission with a 980 nm pump source. Its high absorption allows for shorter active fiber lengths compared to conventional Er-doped fibers emitting in the L band.

These fibers give good modal overlap of the pump with the doped region of the fiber while still maintaining excellent splice characteristics. The high absorption of MetroGain fibers makes them an ideal choice for fiber lasers and ASE sources. Very short cavity lengths for fiber lasers can be realized, which minimizes pulse distortion.



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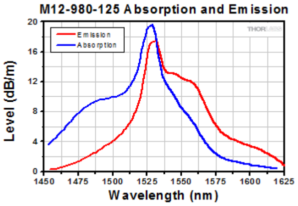

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Item #	Type	Emission Wavelength	Absorption	MFD @ 1550 nm (Nominal)	Cladding Diameter	Coating Diameter (Nominal)	Core NA	Cut-Off Wavelength	(
M5-980-125	Single Mode	C-Band	4.5 - 5.5 dB/m @ 980 nm 5.4 - 7.1 dB/m @ 1531 nm	5.5 - 6.3 µm	125 ± 1 µm	245 ± 15 µm	0.21 - 0.24	900 - 970 nm	
M12-980-125		L-Band	11.0 - 13.0 dB/m @ 980 nm 16.0 - 20.0 dB/m @ 1531 nm	5.7 - 6.6 µm					

- We regret that we cannot provide this proprietary information.

Part Number	Description	Price	Availability
M5-980-125	**Erbium Doped C Band Fiber**	**$13.36** **Per Meter** **Volume Pricing Available**	**Today**
M12-980-125	**Erbium Doped L Band Fiber**	**$13.36** **Per Meter** **Volume Pricing Available**	**Today**

Visit the *Erbium Doped SM and LMA Optical Fiber* page for pricing and availability information:
http://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=1504