

Corning® ER Specialty Optical Fibers

Erbium-Doped Fibers



*For use in
Optical
Amplifiers and
Fiber Lasers*

Manufactured with Corning's patented Outside Vapor Deposition (OVD) process, Corning® ER Specialty Fibers set the world standard for uniformity and reliability. Corning offers Erbium-doped fibers with or without hermetic coating. The hermetic coating offers significant advantage with respect to mechanical reliability and resistance to hydrogen induced optical attenuation degradation. These Erbium-doped fibers have a proven track record in state-of-the-art optical amplifiers, and exhibit consistently low splice loss when coupled with fibers such as Corning® HI 1060 FLEX, Corning® HI 980 and Corning® SMF-28e+® Optical Fiber. Erbium-doped fibers designs are available for conventional C-band, L-band and Reduced Clad (80 μm) applications.

Applications:

- Single and multi-wavelength optical amplifiers (EDFA)
- Digital and analog systems
- CATV amplifiers

Features:

- Outstanding consistency and uniformity using Corning's patented Outside Vapor Deposition (OVD) process
- OVD manufacturing consistency provides repeatability for gain spectrum allowing for the reduction of lot qualifications in amplifier deployment
- Hermetic coating for increased environmental stability and reliability
- Dual acrylate coating system provides excellent protection from microbend-induced attenuation and superior mechanical robustness
- Short and long cutoff wavelength C-band versions available
- Excellent geometry control
- Mode-field diameter designed to match Corning® High Index Specialty Fiber, allowing for efficient coupling with an EDFA

Key Optical Specifications for C-band Fibers

	ER 1550C3	ER 1550C3 LC	RC ER 1550C3
Peak Absorption Range @ 1530 nm (dB/m)	5.0 to 10.0	5.0 to 10.0	5.0 to 10.0
Peak Absorption Range @ 980 nm (dB/m)	≥ 2.5	≥ 3.0	≥ 2.5
Variation Around Peak Absorption per Batch (%)	≤ ± 1	≤ ± 1	≤ ± 1
Maximum Attenuation @ 1200 nm (dB/km)	≤ 15.0	≤ 15.0	≤ 15.0
Cutoff Wavelength (nm)	≤ 1300	≤ 980	≤ 1300
Mode-field Diameter @ 1000 nm (μm)	3.5 ± 0.2	3.6 ± 0.2	3.5 ± 0.2
Mode-field Diameter @ 1550 nm (μm)	5.4 ± 0.4	5.6 ± 0.4	5.4 ± 0.4
Polarization Mode Dispersion (fs/m)	≤ 4	≤ 4	≤ 4

Key Geometric, Mechanical and Environmental Specifications

	ER 1550C3	ER 1550C3 LC	RC ER 1550C3
Cladding Outside Diameter (μm)	125 ± 1	125 ± 1	80 ± 1
Coating Outside Diameter (μm)	245 ± 10	245 ± 10	165 ± 10
Core-to-Cladding Offset (μm)	≤ 0.4	≤ 0.4	≤ 0.4
Proof Test (kpsi)		100	
Standard Lengths		100 m, 500 m, 1 km, 2 km, 5 km	
Operating Temperature (°C)	-60 to 85	-60 to 85	-60 to 85

Performance Characterizations*

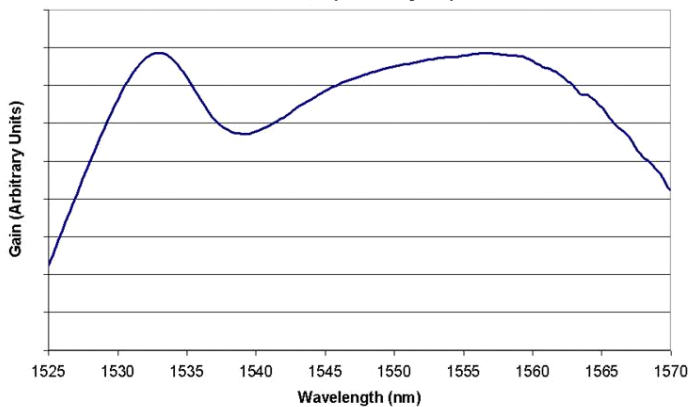
	ER 1550C3	ER 1550C3 LC	RC ER 1550C3
Numerical Aperture	0.23	0.22	0.23
Backscatter (% per meter)	≤ 0.0001	≤ 0.0001	≤ 0.0001

* Values in this table are nominal or calculated values

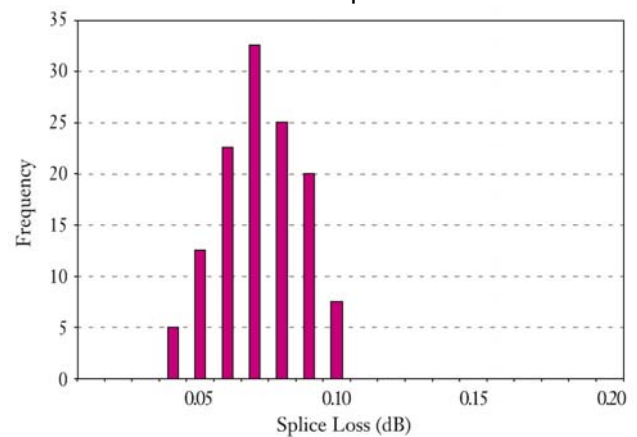
Typical Splicing Loss

	ER 1550C3	ER 1550C3 LC	RC ER 1550C3
To SMF-28e+® Optical Fiber (dB)	0.10	0.10	0.13
To Corning® HI 1060 FLEX Specialty Fiber (dB)	0.05	0.05	0.10
To Corning® HI 980 Specialty Fiber (dB)	0.10	0.10	0.10
To Corning® HI 1060 Specialty Fiber (dB)	0.10	0.10	0.10

Typical Gain Shape for Corning® ER 1550C3 and ER 1550C3 LC Specialty Optical Fibers



Splice Loss of Corning® ER 1550C3 Specialty Fiber to SMF-28e+® Optical Fiber



Key Optical Specifications for L-band Fibers

Peak Absorption Range @ 1530 nm (dB/m)	18.0 to 29.0	
Variation Around Peak Absorption per Batch (%)	$\leq \pm 1$	
Maximum Attenuation @ 1200 nm (dB/km)	≤ 15.0	
Cutoff Wavelength (nm)	≤ 1400	
Mode-field Diameter @ 1550 nm (μm)	5.5 ± 0.3	
Polarization Mode Dispersion (fs/m)	≤ 5	

Key Geometric, Mechanical and Environmental Specifications

Cladding Outside Diameter (μm)	125 ± 1	80 ± 1
Coating Outside Diameter (μm)	245 ± 10	165 ± 10
Core-to-Cladding Offset (μm)	≤ 0.4	
Proof Test (kpsi)	100	
Standard Lengths	100 m, 500 m, 1 km, 2 km, 5 km	
Operating Temperature ($^{\circ}\text{C}$)	-60 to 85	

Performance Characterizations*

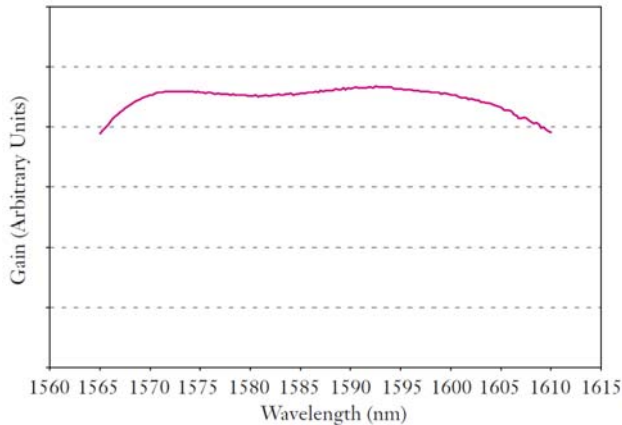
Numerical Aperture	0.23	
Backscatter (% per meter)	≤ 0.0002	
Non-linear Index of Refraction (n_2) (m^2/W)	$\leq 3.5 \times 10^{-20}$	
Effective Area (A_{eff}) (μm^2)	22.5 ± 2.5	

* Values in this table are nominal or calculated values

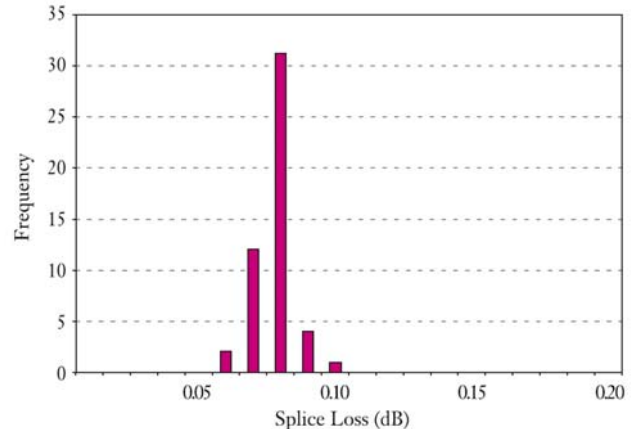
Typical Splicing Loss

To SMF-28e+® Optical Fiber (dB)	0.10	0.10
To Corning® HI 980 Specialty Fiber (dB)	0.10	0.10
To Corning® HI 1060 Specialty Fiber (dB)	0.10	0.10

Typical Gain Shape for Corning® ER 1600L3 Specialty Fiber



Splice Loss of Corning® ER 1600L3 Specialty Fiber to SMF-28e+® Optical Fiber



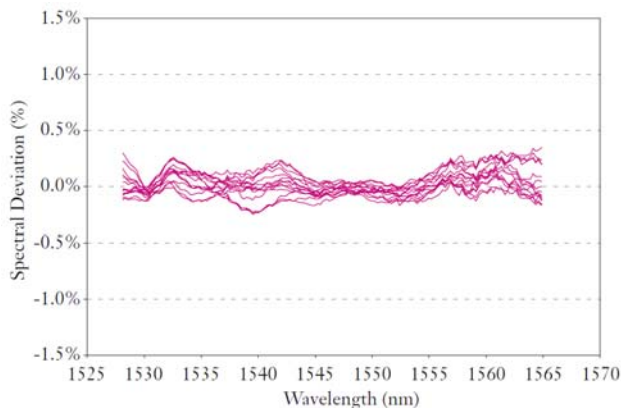
Corning's Outside Vapor Deposition Process

Corning's patented Outside Vapor Deposition (OVD) manufacturing process creates the most consistent fiber in the world. Producing 100 percent synthetic glass, the OVD process greatly reduces, if not eliminates, impurities that can affect fiber performance. It also provides greater degree of control and flexibility in fiber design. Corning is now using seventh generation outside vapor deposition technology, the most advanced in the world today.

Importance of Erbium-doped Fiber Uniformity

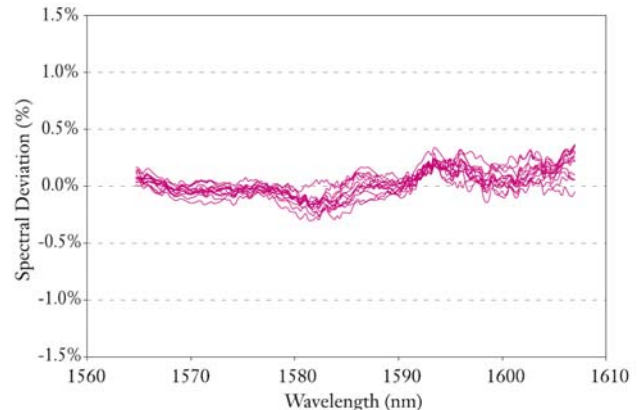
Perhaps the most critical parameter for Erbium-doped fiber in high performance amplifiers is the uniformity of the gain spectrum from one coil to the next. Because Corning produces fiber via the OVD process, it is by far the most uniform in the world. Individual starting core glass blanks are able to generate multiple fiber draw preforms of equivalent composition and profile, ensuring many hundreds of kilometers of fiber with equivalent properties. Other companies utilizing processes like MCVD require recipe replication for each draw preform, which imparts inherent variability. In fact, no other company can address customer requirements with the same level of experience, capacity and precision manufacturing as Corning. In typical high-performance amplifiers built with our Erbium-doped fiber, gain consistency is maximized due to spectral uniformity of the fiber, eliminating the need for frequent adjustments to gain flattening filter design. Variations in gain spectrum and pump power requirements are greatly reduced, which makes for a more predictable amplifier manufacturing process and translates directly to lower costs for customers.

Spectral Uniformity of Corning® ER 1550C3 Specialty Fiber



Representative samples from multiple batches totaling more than 350 km.

Spectral Uniformity of Corning® ER 1600L3 Specialty Fiber



Representative samples from multiple batches totaling more than 125 km.

Corning's ER Design Options

Corning's low cutoff design Type 3 C-band (ER 1550C3 LC), is specifically designed for EDFAs that do not use tight coiling. This fiber ensures single-mode attribute at 980 nm wavelength without coiling. Another benefit of the low cutoff C-band fiber is enhanced 980/1550 absorption ratio which can give enhanced pump power utilization and noise figure in specific EDFA designs. This product is compatible with other Erbium-doped fibers on the market. Corning's high cutoff C-band product (ER 1550C3), which can be coiled to maintain less than 980 nm cutoff, has an optimized profile for demonstrated performance improvements in efficiency as lower Erbium ion concentrations can be used to achieve similar signal band peak absorption (i.e. lower ion-ion interaction). The spectral characteristics of ER 1550C3 LC can be matched to ER 1550C3 while providing equivalent spectral uniformity performance. ER 1550C3 LC fiber offers customers a highly uniform OVD processed fiber alternative to established low cutoff designs, resulting in greater manufacturing control and procurement flexibility.

The Corning Advantage

All Erbium-doped fibers are not equal. Corning understands the each customer's amplifier design varies and their need for custom requirements and gain spectrums are paramount. By combining Corning's fundamental ER fiber processing and reliability features with our customer's unique design needs, Corning is leading the way in low cost EDFA designs. With the confidence of tens of thousands of kilometers experience, make Corning® Erbium-doped fiber your next choice, and feel the advantage.

For more information about Corning's leadership in Specialty Fiber technology visit our website at www.corning.com/specialtyfiber

To obtain additional technical information, an engineering sample or to place an order for this product, please contact us at:

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