

Specialty Fiber Product

Vol.5



Head Office

49 Jangjagol-ro, Danwon-gu, Ansan-si, Gyeonggi-do, Korea

Email

inquiry@tfo.co.kr

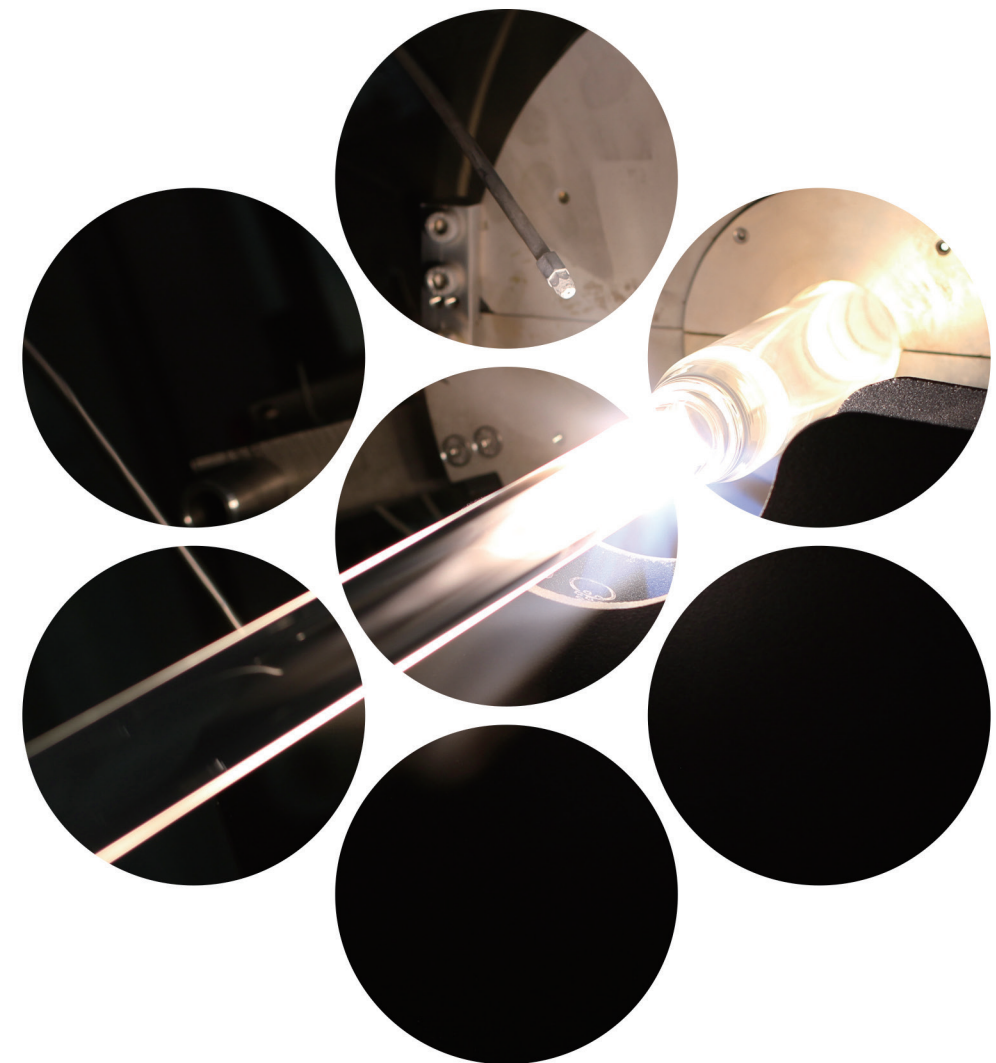
Phone

+82, 31, 489, 5151

FAX

+82, 31, 491, 1555

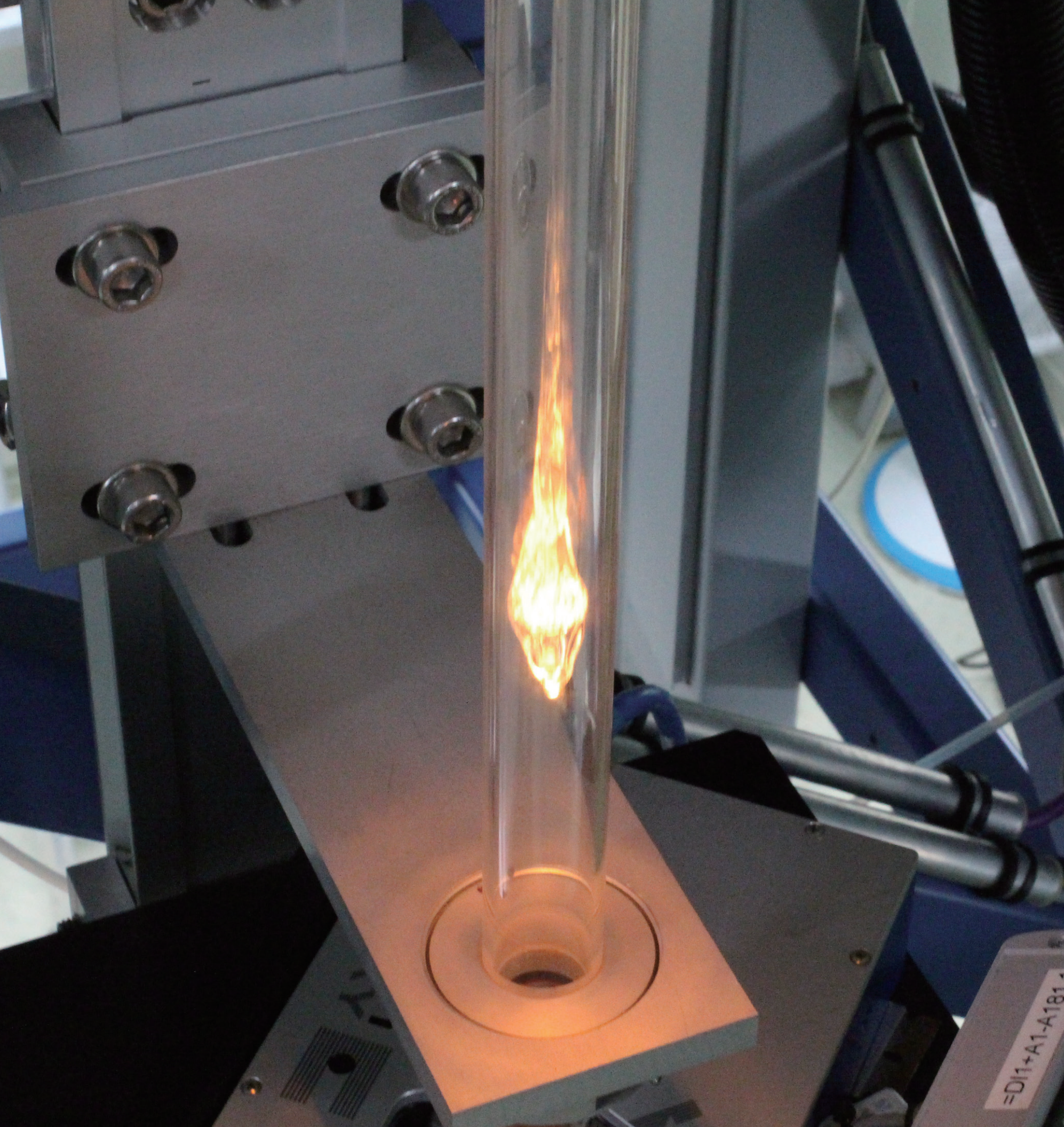
Please visit www.tfo.co.kr for more information



GLOBAL LEADING COMPANY
IN FIBER OPTICS

TAIHAN FIBEROPTICS

- 2017** Developed Medical Fiber Optic Probe
- 2016** Developed Fibers for Laser industry
- 2015** Selected as Inno-Biz(Innovation Business)
- 2014** Developed 200um optical fiber(ANYWAVE 200), Developed optical communication total solution(wire-wireless)
- 2013** Developed Korea's first ultra low loss fiber(ANYWAVE-LL)
- 2011** Business acquisition sign of Taihan Electric Wire Co., LTD. optical communication division
(Change the company name : Optomagic Co., Ltd. → TAIHAN FIBEROPTICS Co., Ltd.)
- 2010** Succeeded in mass-producing its "Bending-reinforced optical fiber"
- 2004** Developed the intergrated FTTH solution
- 2001** Taihan Electronic Wire Group separates the fiber optics department as Taihan Fiberoptics Co., Ltd.
(formerly Optomagic Co., Ltd.) and begins production of fiber optics
- 1998** Optical communication plant expansion in Anyang
(Introduction of VAD facilities and DRAWING facilities, Construct mass production system)
- 1996** Developed fiber distribution frame, optical terminal box and mechanical optical connector
- 1988** Developed submarine optical cable and leakage coaxial cable
- 1985** Began manufacturing of optical fiber ground wire(OPGW)
- 1981** Produced the nation's first optical cable & long wavelength low-loss fiber
- 1977** Developed optical fiber in Korea(MCVD method)
- 1974** Established TAIHAN FACTORY(Before Optomagic Co., Ltd.)
- 1961** Produced lead-sheathed communication cable for the first time in Korea
- 1955** Established TAIHAN ELECTRIC WIRE CO., LTD.



Index

Specialty Fiber Research & Development	01
Ytterbium Doped Double-Clad Fiber	03
Passive Double-Clad Fiber	05
Polarization Maintaining Fiber	07
Pure-silica Light Guide Fiber (Wavelength 250~1200nm)	09
Pure-silica Light Guide Fiber (Wavelength 400~2200nm)	11
Pure-silica Hard-Clad Light Guide Fiber	13
Gain Medium Packaging Service(OEM)	15
OEM Fiber Lasers Development & Productions	16
Few Mode Fiber	17
Capillary Tube	19
Medical Fiber Optic Probes(FOP)	21
Fiber Optic Cable & Bundle	23
Sensing Cable for harsh environment	25

Specialty Fiber Research & Development



TFO focus on developing the VAD & MCVD process for producing the innovative specialty optical fiber.

We are supplying our unique specialty fibers for aerospace, military, medical, industrial and scientific applications, developing the world's highest performance and quality fiber at manufacturing scale.

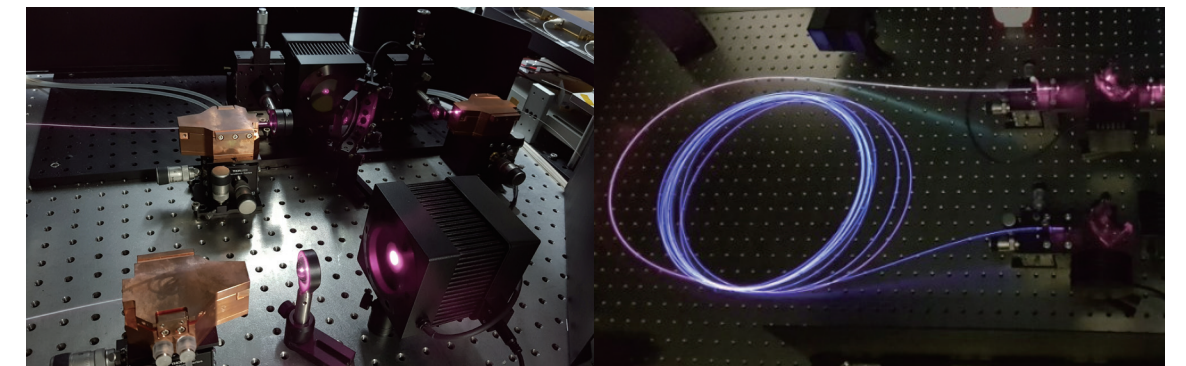
TFO offers a wide range of specialty fibers based on the VAD & MCVD process . Low scattering loss, high doping concentration of rare earth ions, large mode field diameter, and flexibility for constructing complex microstructure fibers are the distinguished features of TFO's Specialty fibers.

Business Area

Custom design & OEM

- Rare earth(Er/Yb/Tm) doped Fibers
- Fiber laser components
- OEM fiber laser Module
- Custom design of special structure optical fibers

Evaluation of Specialty optical fibers



Ytterbium Doped Double-Clad Fiber

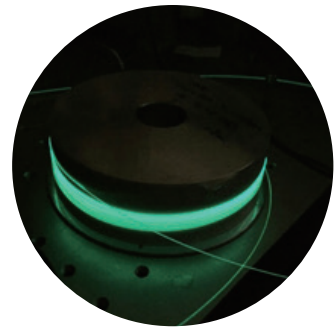
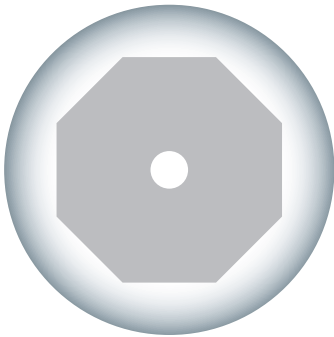
TFO’s Large Mode Area(LMA) Ytterbium doped dual clad fiber is designed for high power fiber lasers and amplifiers. This fiber has octagonal shape of pumping cladding, and low photo-darkening performance. TFO’s LMA-YDF finds applications in medical, industrial and military with operating at ~kW of CW output power.

Feature

- Excellent beam quality
- Large mode area
- Optimization for low photo-darkening
- Core and cladding pumped designs for ~kW output power

Application

- Industrial / military / medical
- Metal processing
- Laser LIDAR
- High power communications amplifiers
- High average power pulsed amplifiers



Specification		YDF-DC-10/125	YDF-DC-20/400	YDF-DC-25/400
Core	Core Diameter(μm)	10.5 ± 1.0	20.0 ± 1.5	25.0 ± 1.5
	Core NA	0.080 ± 0.005	0.060 ± 0.010	0.060 ± 0.010
	Rare-Earth Material	Ytterbium		
Cladding	Cladding Geometry	Circular, Octagonal		
	Cladding Diameter(μm) (flat-to-flat)	125 ± 1.5	400 ± 15.0	400 ± 15.0
	Cladding NA	≥ 0.46		
	Material	Pure Silica		
	Cladding Absorption	1.9±0.3dB/m (@915nm)	0.4±0.05dB/m (@915nm)	0.6±0.1dB/m (@915nm)
Outer Cladding	Material	Low index, F-doped Silica		
Operating Temperature		-40 ~ 85 ℃ (Typical)		
		~ 150 ℃ (High Temp)		

※ Custom designs are available upon requests

Passive Double-Clad Fiber

TFO’s double-clad passive fibers are ideally suited for matching fiber lasers and amplifiers. These are matched to active LMA YDF 10/125 to ensure splice compatibility and low loss.

Feature

- Precision matching, providing low splice loss
- Useful for transmitting high CW powers
- Clad diameter is designed to ‘fit-in’ octagonal active fibers



Application

- Fiber-based components for fiber lasers
- Pulsed fiber lasers and amplifiers
- LIDAR
- Material Processing
- Scientific/Research

Product code.	Core(μm)	Clad(μm)	Buffer(μm)
LMA-GDF-10/125	10.5 ± 1.0	125 ± 1.0	245 ± 10
LMA-GDF-20/130	20 ± 1.5	130 ± 1.0	245 ± 10
LMA-GDF-25/130	25 ± 2.0	130 ± 2.0	245 ± 15
LMA-GDF-25/250	25 ± 1.5	247 ± 3.0	395 ± 15
LMA-GDF-20/400	20 ± 1.5	395 ± 5.0	550 ± 15
LMA-GDF-25/400	25 ± 1.5	395 ± 5.0	550 ± 15

Specification		Value
Core	Core NA	0.065 ± 0.005, 0.080 ± 0.005
	Core/Clad offset	≤ 5%
Clad	Cladding NA	≥ 0.46
	Material	Pure Silica
	Clad Non-Circularity	≤ 1%
Coating	Material	Low Index
Attenuation	Core	Attenuation Core Spec " ≤ 8dB/km(@1200nm), ≤ 12dB/km(@1300nm)
	Clad	≤ 15dB/km (@1095nm)

※ Custom designs are available upon requests

Polarization Maintaining Fiber

TFO’s PANDA fibers have a excellent optical performance in polarization~maintaining because of the accurate geometric structure and constant concentrations of boron in the fiber.

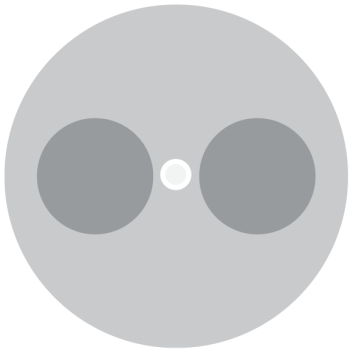
Available in a wide range of operating wavelengths spanning from 780nm to 1650nm, TFO’s PM fibers are optimized for sensor systems, Gyroscope and telecom applications.

Feature

- High birefringence
- Low polarization crosstalk
- Single~mode design from 780~1100nm, 1450~1650nm
- Mode matched for splicing

Application

- Laser diode pigtails
- Bio~medical
- Interferometric sensors
- Polarization~based modulators
- Couplers
- Gyroscope



Classification	TFO-PMF-G-850	TFO-PMF-G-1300	TFO-PMF-G-1550
Operating Wavelength	850nm	1300nm	1550nm
Cladding Diameter	80 ± 1μm	80 ± 1μm	80 ± 1μm
Coating Diameter	155 ± 10μm	155 ± 10μm	155 ± 10μm
Coating Material	UV cured, Dual acrylate	UV cured, Dual acrylate	UV cured, Dual acrylate
Numerical Aperture (NA)	0.16 ± 0.01	0.18 ± 0.01	0.2 ± 0.01
Attenuation	≤ 4.5dB/km (@850nm)	≤ 2.5dB/km (@1300nm)	≤ 2.5dB/km (@1550nm)
Cutoff Wavelength	660 ~ 780nm	1150 ~ 1270nm	1230 ~ 1530nm
MFD	4.0 ~ 6.0μm (@850nm)	5.0 ~ 7.0μm (@1300nm)	5.0 ~ 7.0μm (@1550nm)
Beat Length	< 1.5mm (@633nm)	< 1.5mm (@633nm)	< 1.5mm (@633nm)
Normalized Crosstalk	≤ -30dB at 100m @850nm	≤ -30dB at 100m @1300nm	≤ -30dB at 100m @1550nm
Operating Temperature	-40 ~ +85℃	-40 ~ +85℃	-40 ~ +85℃
Proof Test Level	≥ 100kpsi	≥ 100kpsi	≥ 100kpsi

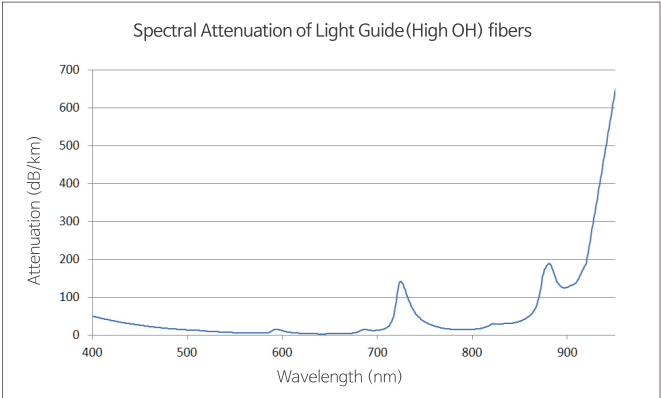
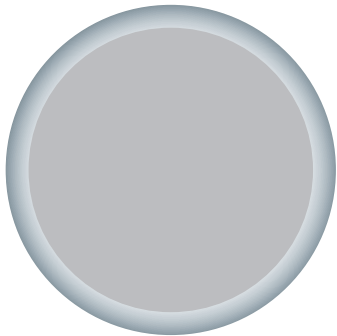
※ Custom designs are available upon requests

Pure-silica Light Guide Fiber (Wavelength 250~1200nm)

These step-index multimode fibers feature a pure silica core with a fluorine-doped silica cladding, and are available with high hydroxyl ion (OH) concentrations for UV to visible(250~1200nm) light guide applications.

Application

- Fiber-based components
- Lasers delivery and spectroscopy
- Medical
- Scientific/Research



Product code.	Core(μm)	Clad(μm)	Buffer(μm)
SH100F110-22-PI125	100 ± 3.0	110 ± 3.0	125 ± 3.0
SH105F125-22-AC245	105 ± 3.0	125 ± 3.0	245 ± 5.0
SH190F200-22-PI220	190 ± 4.0	200 ± 4.0	220 ± 4.0
SH200F220-22-PI240	200 ± 4.0	220 ± 4.0	240 ± 5.0
SH400F440-22-AC480	400 ± 10.0	440 ± 10.0	480 ± 10.0
SH600F660-22-AC710	600 ± 20.0	660 ± 20.0	710 ± 30.0
SH800F880-22-AC950	800 ± 20.0	880 ± 30.0	950 ± 30.0
SH1000F1100-22-AC1300	1000 ± 30.0	1100 ± 30.0	1300 ± 40.0
SH1200F1350-22-AC1600	1200 ± 40.0	1350 ± 40.0	1600 ± 50.0
SH1500F1650-22-AC2100	1500 ± 50.0	1650 ± 50.0	2100 ± 70.0

Specification	Value
Operating Wavelength	250 ~ 1,200 nm
Numerical Aperture(NA)	0.15, 0.22, 0.24 ± 0.02
Core Diameter	Max. 1500 μm
Coating Material	Low-index polymer, Acrylate, High-Temperature Acrylate, Polyimide, ETFE
Operating Temperature	Acrylate : - 40 ~ 85 °C, High-Temperture Acrylate : - 40 ~ 150 °C ETFE (Tefzel) : - 65 ~ 150 °C, Polyimide : - 190 ~ 300 °C
Minimum Bending Radius	Low Index > 240 x Cladding Diameter (Long term)

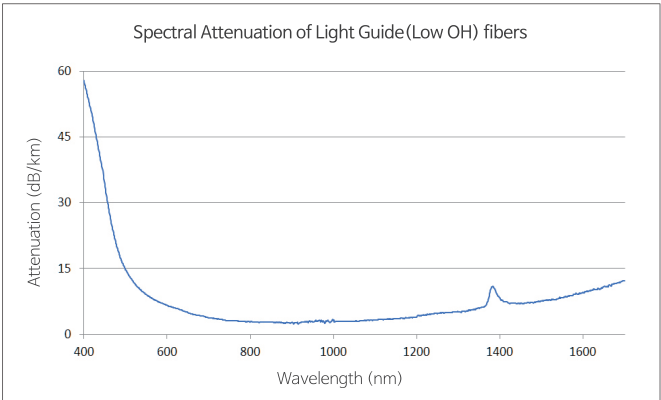
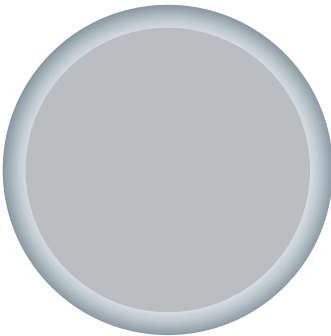
※ Custom designs are available upon requests

Pure-silica Light Guide Fiber (Wavelength 400~2200nm)

These step-index multimode fibers feature a pure silica core with a fluorine-doped silica cladding, and are available with low hydroxyl ion (OH) concentrations for visible to NIR(400~2200nm) light guide applications.

Application

- Fiber-based components
- Lasers delivery and spectroscopy
- Medical
- Scientific/Research



Product code.	Core(μm)	Clad(μm)	Buffer(μm)
SL50F70-22-PI90		110 ± 3.0	125 ± 3.0
SL100F110-22-PI125	100 ± 3.0	110 ± 3.0	125 ± 3.0
SL105F125-22-AC245	105 ± 3.0	125 ± 3.0	245 ± 10.0
SL106F125-22-AC245	106.5 ± 3.0	125 ± 3.0	245 ± 10.0
SL135F155-22-AC320	135 ± 3.0	155 ± 3.0	320 ± 10.0
SL200F220-22-PI240	200 ± 4.0	220 ± 4.0	240 ± 5.0
SL200F220-22-AC320	200 ± 4.0	220 ± 3.0	320 ± 15
SL300F330-22-PI370	300 ± 6.0	330 ± 6.0	370 ± 10.0
SL400F440-22-PI480	400 ± 10.0	440 ± 10.0	480 ± 15.0
SL400F440-22-AC625	400 ± 10.0	440 ± 10.0	625 ± 20.0
SL550F600-22-AC630-EF1040	550 ± 20.0	600 ± 20.0	1040 ± 30.0
SL600F660-22-PI710	600 ± 20.0	660 ± 20.0	710 ± 20.0
SL800F880-22-AC1100	800 ± 20.0	880 ± 25.0	1100 ± 30.0
SL1000F1100-22-AC1300	1000 ± 30.0	1100 ± 30.0	1300 ± 40.0
SL1200F1350-22-AC1600	1200 ± 40.0	1350 ± 40.0	1600 ± 50.0

Specification	Value
Operating Wavelength	400 ~ 2,400nm
Numerical Aperture(NA)	0.15, 0.22, 0.24 ± 0.02
Core Diameter	50 - 1500μm
Coating Material	Low-index polymer, Acrylate, High-Temperature Acrylate, Polyimide, ETFE
Operating Temperature	Acrylate : - 40 ~ 85°C High-Temperture Acrylate : - 40 ~ 150°C ETFE(Tefzel) : - 65 ~ 150°C Polyimide : - 190 ~ 300°C
Minimum Bending Radius	240 x Cladding Diameter (Long term)

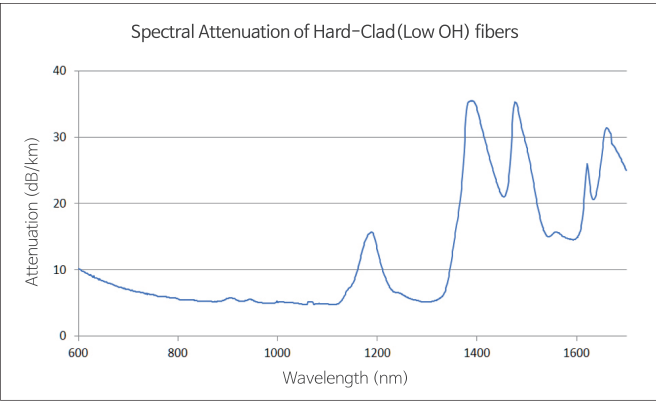
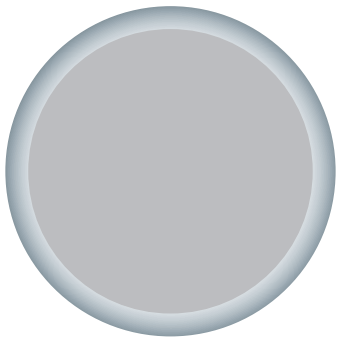
※ Custom designs are available upon requests

Pure-silica Hard-Clad Light Guide Fiber

These hard-clad, multimode, step-index fibers composed of a pure silica core with a fluoropolymer cladding, featuring for variety of light guide applications.

Application

- Fiber-based components
- Lasers delivery and spectroscopy
- Medical
- Scientific/Research



Product code.	Core (μm)	Clad (μm)	Buffer (μm)
SL200P230-37-EF500	200 ± 4.0	230 ± 4	500 ± 10
SL300P330-37-EF650	300 ± 6.0	330 ± 4	650 ± 20
SL400P430-37-EF730	400 ± 10.0	430 ± 10	730 ± 20
SL600P630-37-EF1040	600 ± 20.0	630 ± 20	950 ± 30
SL600P660-37-EF950	600 ± 20.0	660 ± 20	1040 ± 30
SL1000P1035-37-EF1400	1000 ± 30.0	1035 ± 20	1400 ± 40

Specification	Value
Operating Wavelength	300 ~ 1,200nm / 400 ~ 2,200nm
Numerical Aperture(NA)	0.37 ± 0.02
Core Diameter	Max. 1500μm
Clad Material	Fluoropolymer
Buffer Material	Acrylate, High-Temperature Acrylate, ETFE (Option)
Operating Temperature	- 65 ~ 150 °C
Minimum Bending Radius	240 x Cladding Diameter (Long term)

※ Custom designs are available upon requests

Gain Medium Packaging Service (OEM)

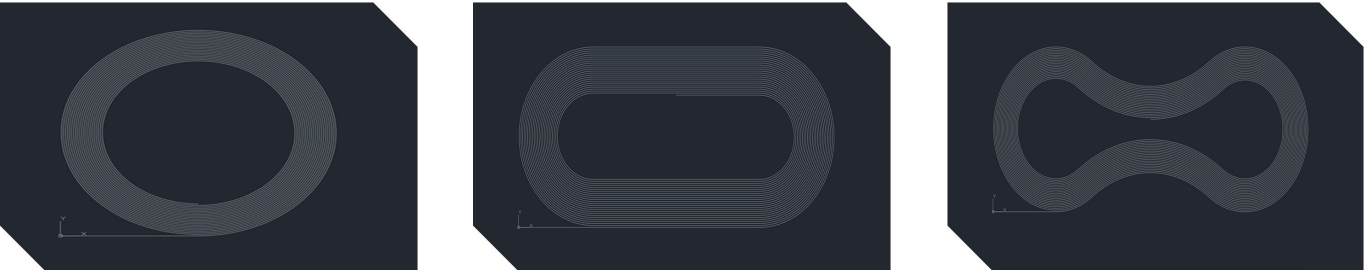
Cooperate with Lumenics Co., Ltd.

Taihan Fiber Optics manufactures and provides fiber laser gain module according to user's requirements. With our automatic winding technology, the gain fiber optic is coiled and provided in the form of a module without stress and distortion.

Advantage

- Compact design
- Excellent output beam quality
- Customer request patterning
- Easy use and Cost-effective

Winding patterns



OEM Fiber Lasers Development & Productions

Cooperate with Lumenics Co., Ltd.

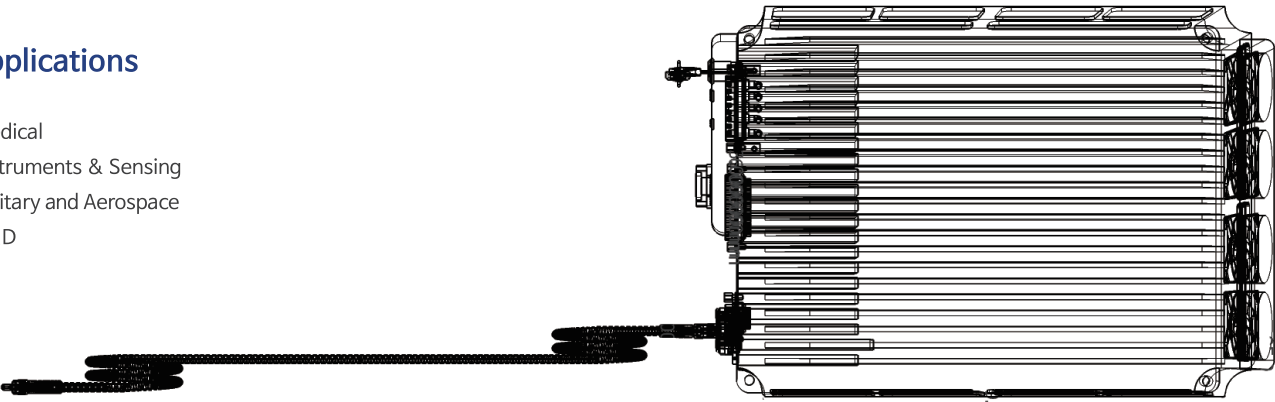
Taihan Fiber Optics is specialized in fiber lasers. OEMs in general industrial lasers, as well as laser development and production for special purposes in the aerospace / defense industries. We can develop modular fiber lasers and laser systems and related specialty fiber optic devices. Therefore TFO can be your trusted partner in your laser business.

Business Area

- Er/Yb/Tm doped Fiber Lasers
- Continues/Pulsed Fiber Lasers
- Module/Turnkey System

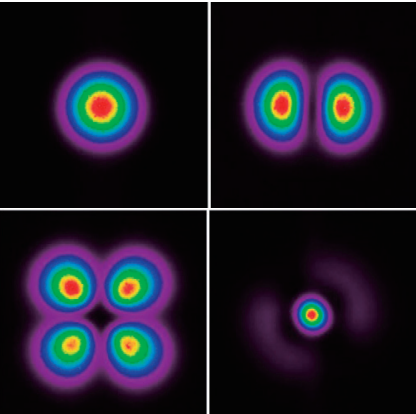
Applications

- Medical
- Instruments & Sensing
- Military and Aerospace
- R&D



Few Mode Fiber

TFO’s Few Mode Fibers(FMF) are manufactured by the vapor-phase axial deposition(VAD) method, which exhibit good cylindrical symmetry in the fiber structure. TFO’s FMF is optimized for Space Division Multiplexing (SDM) communication systems.



Feature

- Support 6-modes at C-band (LP01, LP11a, LP11b, LP21a, LP21b, LP02)
- Excellent geometric uniformity in fiber length direction
- Improved amplifier pump efficiency

Application

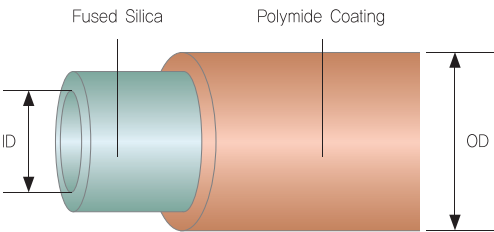
- Space Division Multiplexing (SDM)
- Erbium-doped fiber amplifier (EDFA)

Specification	Value
Core Diameter	10μm (Nominal)
Cladding Diameter	125.0 ± 0.7μm
Core / Cladding Material	Germanium Doped Silica/Silica
Coating Diameter	242 ± 5μm (Nominal)
Coating Material	Dual layers of UV-cured acrylate
Fiber Proof Test Level	≥ 100kpsi
Packaging (km (1000ft))	25.2 (82.7) / 50.4 (165.4)

※ Custom designs are available upon requests

Capillary Tube

TFO’s Capillary Tubes feature Polyimide Coating and strict ID and OD tolerances that can be used in the Scientific, Industrial and Medical applications.



Feature

- Endure High Temperature up to 300℃
- Synthetic Fused silica construction
- High Tensile Strength

Application

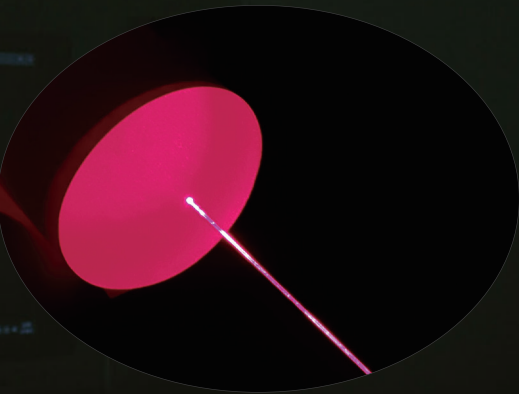
- Flow Control Systems
- Analytical Chemistry
- Industrial and medical
- Scientific/Research

Product Code	Inner Diameter(μm)	Outer Diameter(μm)
TFO-CAP-50/70	50 ± 3	70 ± 6
TFO-CAP-70/100	70 ± 3	100 ± 6
TFO-CAP-100/180	100 ± 4	180 ± 10
TFO-CAP-150/250	150 ± 4	250 ± 10
TFO-CAP-180/300	180 ± 4	300 ± 10
TFO-CAP-200/360	200 ± 6	360 ± 10
TFO-CAP-400/600	400 ± 6	600 ± 10

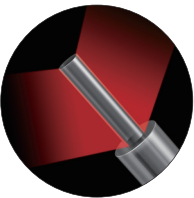
Specification	Value
Numerical Aperture	0.22
Core Material	Silica
Buffer Material	Fused Silica
Jacket Material	Acrylate, Polyimide
Temperature Range	-100~300℃

※ Custom designs are available upon requests

Medical Fiber Optic Probes (FOP)



TFO’s Optical Fiber Probe(FOP) is an optimized product for a wide range of optical therapy and treatments including Photo Dynamic Therapy(PDT), Low Level Laser Therapy(LLLT) and etc.



Cylindrical Tip



Ball Tip



Frontal Tip



Angled Tip



Corn Tip

Feature

- Side emitting type
- Uniform illumination
- Available for VIS & NIR wavelengths
- Available for controlling diffusion length

Application

- Photo Dynamic Therapy, PDT
- Low Level Laser Therapy, LLLT
- Endoscopy
- Cancer treatment
- Optical therapy and treatments

Product code	Core(μm)	Hard Clad(μm)	(Optional) Buffer Diameter(μm)
TFO-FOP-SL280P350T600	280 ± 5	350 ± 10	600 ± 50
TFO-FOP-SL300P400T700	300 ± 5	400 ± 10	700 ± 50
TFO-FOP-SL400P500T800	400 ± 10	500 ± 10	800 ± 50
TFO-FOP-SL600P700T1000	600 ± 10	700 ± 15	1,000 ± 50

Specification	Value
Wavelength Range	300 ~ 1,200nm / 400 ~ 2,200nm
Numerical Aperture (NA)	0.37±0.02
Probe Shape	Cylindrical Tip (CT), Ball Tip (BT), Front Tip (FT), Angled Tip (AT), Corn Tip
Standard Length	1m ~ 3.5m (Customized)
Core Material	Silica
Clad Material	Polymer
Buffer Material (Optional)	Teflon
Jacket Material	PVC
Fiber Connector	SMA905 (Customized)

※ Custom designs are available upon requests

Fiber Optic Cable & Bundle

TFO provides various FOP(Fiber Optics Probe) solutions which can adapt 185~2,400nm wavelength transmission for spectroscopy. TFO optical fibers allow our valued customers to make photonics solutions in many industries. We can develop solutions to solve the problem in collaboration with our valued customers.



Feature

- Various Length
- Bend protection
- AR Coating
- Customized cable

Application

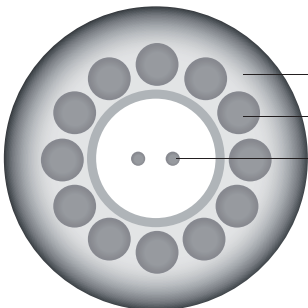
- UV–VIR–NIR laser beam delivery
- Spectroscopy
- Scientific and medical
- Industry

Classification	Typical	Customized
Wavelength Range	185 ~ 1,150nm	380 ~ 2,400nm
Fiber Material	Silica	Silica / Multi Composition Glass
Core Diameter	50, 100, 150, 200, 300, 500, 600, 800μm	50, 100, 150, 200, 300, 500, 600, 800μm
Numerical Aperture (NA)	0.22	0.22 ~ 0.66
Operating Temperature Range	-65 ~ +300°C	-65 ~ +300°C / -65 ~ +125°C
Jacket Material	PVC, PTFE, Metal, Stainless Steel	Other Jackets available
Fiber Connector	SMA905 to probe	Various

※ Custom designs are available upon requests

Sensing Cable for harsh environment

TFO’s Armored Stainless Steel cables can be used in a variety of applications such as temperature, acoustic and vibration sensing in harsh environment.



Jacketing
Armored Wires
Metal-Coated Fiber

Feature

- High Strength stainless steal wire
- Flexible
- Jacket options
- Gel Options
- High temperature harsh environment
- Oil & gas environment

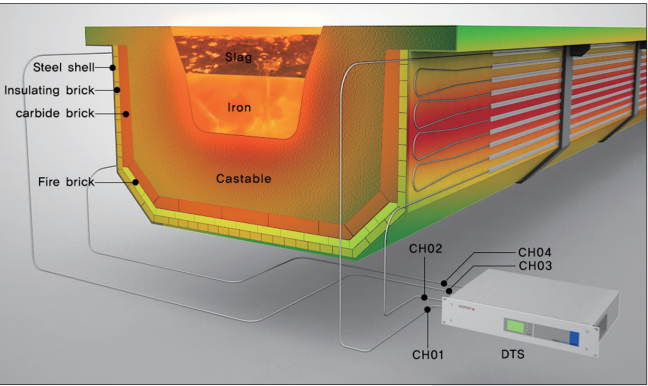
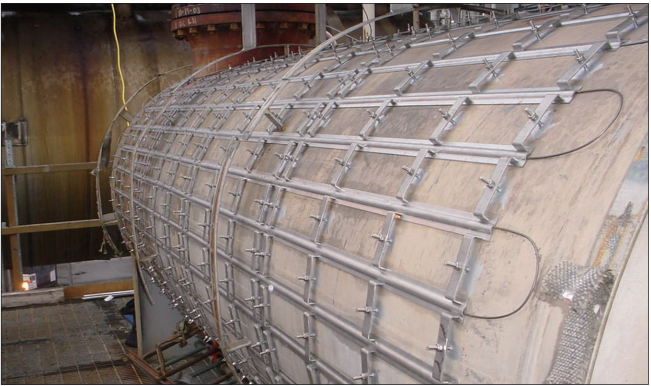
Application

- Distributed Temperature System
- Distributed Acoustic System
- FBG Sensor
- High Vacuum Device
- Radiation resistant sensor

Specifications

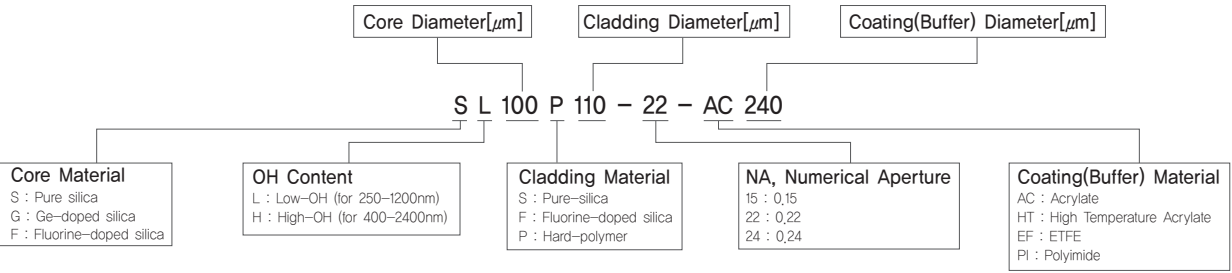
Classification	Description and value		
Fiber Account	Polyimide	Aluminum	Gold
Operating Temperature Range	-200 ~ 300 °C	-269 ~ 400 °C	-269 ~ 700 °C
Armored Wire	Stainless Steel		
Jacket Material	None or Options such as PTFE, PFA, ETFE		

※ Custom designs are available upon requests



Temperature range
Up to 150~300 degree

Ordering information



GLOBAL

LEADING COMPANY

IN

FIBER OPTICS

