Laboratory of Special Optical Fibers

RTIOM S.I.Vavilov State Optical Institute, JC

Saint-Petersburg, Russia

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Laboratory Overview

Located in Saint-Petersburg, Russia and established in 1982 our laboratory - the leading manufacturer of special optical quartz fibers and fiber-optic products in Russia. The laboratory is one of advanced research-and-production divisions of S.I.Vavilov Federal Optical Institute.

The fibers and fiber-optic products are used in research and industrial applications in the areas of spectroscopy, analytical chemistry, sensing applications, medical sub-components, various space applications, and a wide range of military applications.

The large scientifical experience with flexibility of technological processes allow our laboratory to develop and manufacture various fiber-optical products having the high-level characteristics.

Now we develop and produce the next fiber optical products:

Single- and multimode fibers

Fibers with silicone, acrylate and metallic coatings

UV broadband multimode fibers

Laser radiation transmitting fibers

Polarisation maintaining singlemode fibers

High-strength fibers

Photonic crystal fibers and microstructured lightguides

Mono- and polycapillaries with various coatings

Fiber-optical cables and

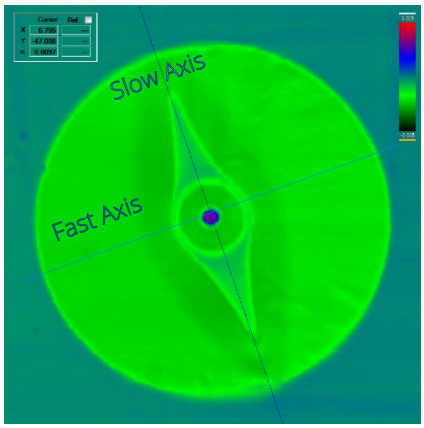
Fiber-optical bundles for light radiation transmitting

According to your wishes we can:

- To design optical fibers or fiber-optic products with the set characteristics and technological process for manufacturing of the fiber
- To develop a manufacturing process of fiber from your material
- To produce a fiber meeting to your requirements, including rod-preform formation, drawing of fiber with various diameters and lengths, and also manufacturing of fiber-optical bundles
- To test optical fibers for optical, geometrical and mechanical characteristics.

Technical support: +7-812-560-2044 info@fiber-lab.ru

Polarization-Maintaining, Single Mode Optical Fiber



PM fibers are singlemode fibers, developed to maintain the polarization properties of linearly polarized light sources. The light is launched along either the slow or fast axes of the fiber through applying of stressing cladding that creates birefringence in the fiber's core.

PM40 are bend- and temperature-insensitive PM fibers. They are commonly used in fiber optic gyroscopes (FOG) applications. These fibers are designed for applying at small bend diameters and over a wide temperature range.

PM125-1550-PR are photosensitive fibers and can be exposed to UV light to change their refractive index. This property allows to use photosensitive fibers in creation of Fiber Bragg Gratings.

PM80- and PM125-1550 are designed for use at1550 nm, these fibers are used in all PM applications for data and telecom.

Typical applications
FOGs Fiber Bragg gratings Laser pigtailing Small form factor couplers Specialty sensors

	PM40-810	PM40-1310	PM80-1550	PM125-1550	PM125-1550-PS
Wavelength Range (nm)	800-1100	1200-1500	1300-1650	1300-1650	1500-1650
Cut-off Wavelength (nm)	700-780	1150-1280	1300-1480	1200-1500	1400-1500
Attenuation (dB/km)	<8 @810 nm	<6@1310 nm	<2 @1550 nm	<2 @1550 nm	<4 @1550 nm
h-parameter (m^{-1})	$<5\cdot10^{-4}$	$<5\cdot10^{-4}$	$<2\cdot10^{-5}$	$<2\cdot10^{-5}$	$<2\cdot10^{-5}$
Beat Length (mm)	<1.8	<2.5	<3	<3	<3
Mode Field Diameter (μm)	2.8±0.2	2.8±0.2	6±0.5	8±0.8	6±0.8
Cladding Diameter (μm)	40±1	40±1	80±1	125±2	125±2
1st Coating Diameter (μm)	95±5	95±5	115±2	190±5	245±10
2nd Coating Diameter (μm)	n/a	n/a	160±4	245±10	n/a
Coating Material	UV-cured acrylate				
Minimum Bend Radius (mm)	2	2	4	12	12
Proof-Test (%)	1				
Operating Temperature (°C)	-45 - +80				

Our PM fibers can be designed for wide wavelength range within visible and infrared spectrum.

0.12 NA Multimode, Graded-Index Core, UV and Visible Transparent, Low Dispersion Fiber

These fibers have a fiber core with a refractive index that varies from the center to the edge. The graded-index fibers provides a significant decrease in modal dispersion when compared to step-index fibers.

Utilizing a graded-index design, these 0.12 NA multimode fiber demonstrate high bandwidth UV optical pulses over long distances without pulse distortion and significant attenuation.

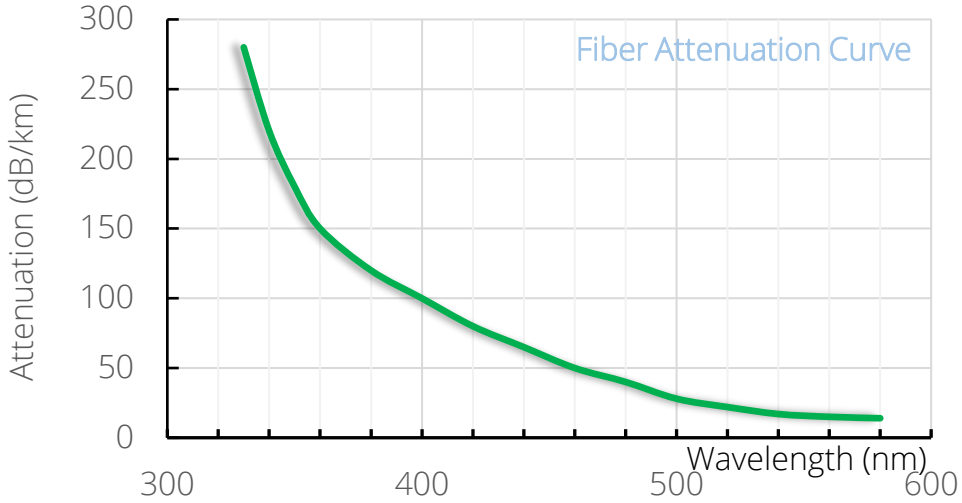
Typical Applications

Transportation of subnanosecond UV laser diagnostic signals

Fluorometric analysis of microscopic objects Medicine (UV-spectra therapy)

	LD125	LD135	LD340	LD590
Wavelength Range(nm)	300-800			
NA	0.12			
Attenuation (dB/km)	<190 @351 nm <20 @527 nm			
Pulse Dispersion (psec/m)	≤1.0 @351 nm ≤0.5 @527 nm			
Bandwidth (MHz·km)	≥440 @351 nm ≥880 @527 nm			
Fiber Construction	Core/Silica Cladding/Coating			
Core Diameter (μm)	62.5±2	100±2	250±5	435±7
Cladding Diameter (μm)	125±2	135±2	340±5	590±10
Coating Diameter (μm)	210±8	230±8	450±10	750±15
Coating Material	UV-cured acrylate			
Minimal Bend Radius (mm)	35	40	100	180
Proof-Test, %	0.5			
Operating Temperature (°C)	-45 - +80			

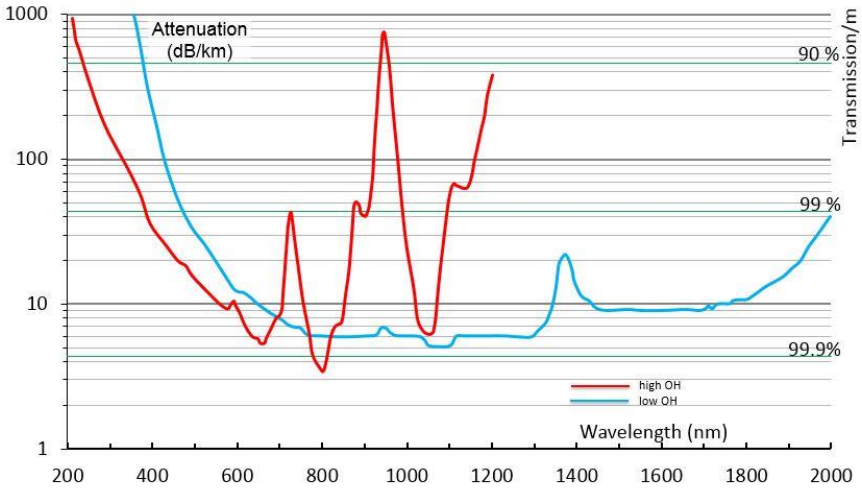
The 62.5/125 fiber can be handled just like standard telecommunication fiber.



0.22 NA Silica Core, Glass Cladding Multimode Fiber, Step Index

The step index fiber is designed with a constant index of the refraction in the core glass. Typically, the fiber core is fused silica, while the fiber cladding is fused silica doped with F.

There are fibers with the low hydroxyl-ion content (Low –OH) for VIS-NIR range of spectrum and with the high hydroxyl-ion content (High –OH) for UV-VIS range of spectrum.



These fibers can be coated by polymer or metalized. A germetic tin or plumbum coating, unlike polymeric, is roentgenocontrast. Germetic coating admits sterilisation and provides an invariance of optical and mechanical characteristics of the fiber at long influence of humidity, pH, temperature.

The fibers are available in a variety of a core diameter of 100 μm-1000 μm.

Large-core fibers are also well suited for high power applications as the power is transmitted through a large cross section of a fiber core.

Typical applications

Medical lasers Spectroscopy Light transmission Laser power transmission

		QF200	QF400	QF600	QF800	QF1000
Wavelength Range (nm)		250-1200 High -OH 400-2000 Low -OH				
NA		0.22				
Fiber Construction		Silica Core/ F-doped Silica Cladding/Coating				
Core Diameter (μm)[a]		200±5	400±7	600±10	800±12	1000±15
Cladding Diameter (μm)[b]		220±5	440±7	660±10	880±12	1100±15
Coating Diameter (μm)	acrylate	250-500	500-750	720-950	1050±10	1300±10
	tin	265±10	485±10	705±10	925±10	1145±10
Coating Material		UV-cured acrylate, tin				
Minimal Bend Radius (mm)		13	26	39	52	65
Proof-Test (%)		1				
Operating Temperature (°C)		-45 - +80 (acrylate)		-50-+200 (tin)		-60-+300 (plumbum)

[a]-some diameters presented [b]-clad/core ratio is equal 1.1

The fibers are available in any integer length, starting from 1 m

0.36 & 0.5 NA Polymer Clad Multimode Optical Fiber, Step Index

These fibers feature a silica core and a light-reflecting polymer cladding. The polymer cladding enables a higher NA than a silica cladding and reduces cost. We apply two types of polymer cladding.

Silicone light-reflecting cladding enables a NA of 0.36, while applying of hard polymer cladding increases NA up to 0.5. Hard Clad fibers are the ideal choice for disposable medical products.

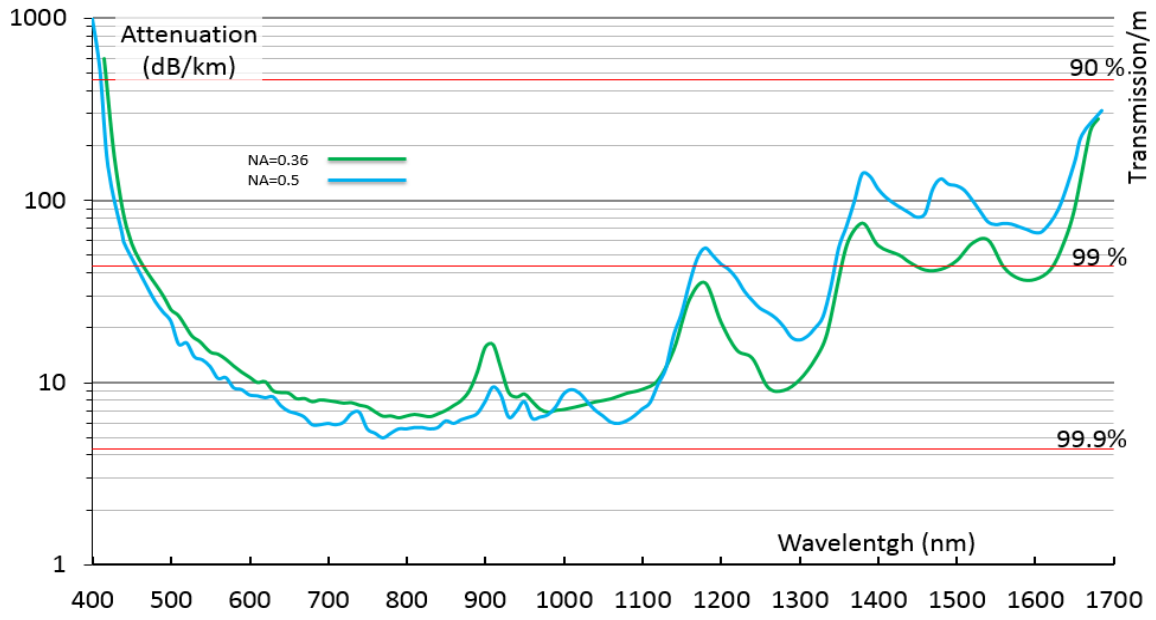
These fibers are available with Acrylate coatings

Typical Applications

Spectroscopy | Medical diagnostics | Laser radiation transfer | Sensors

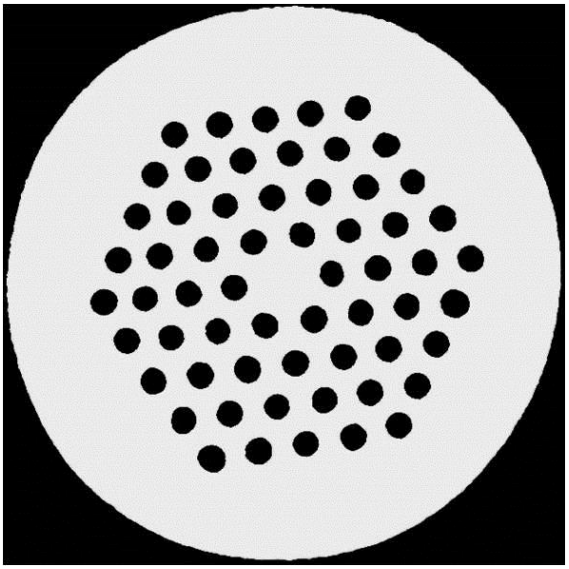
	QP100		QP200		QP400
Wavelength Range (nm)	400-1700				
NA	0.36-0.5				
Fiber Construction	Silica Core/Polymer Cladding/ Coating				
Core Diameter (μm)[a]	100±2		200±5		400±7
Polymer Cladding Diameter (μm)	125±2	150±4	225±4	250±4	480±6
Coating Diameter (μm)	160-215	240-245	260-395	405-515	590-665
Cladding Material	Silicone compound (n=1.413 @632.5 nm; NA=0.36) Hard polymer (n=1.37 @632.5 nm; NA=0.5)				
Coating Material	UV-cured acrylate				
Minimum Bend Radius (mm)	13		26		52
Proof-Test (%)	1				
Operating Temperature(°C)	-45 - +150				

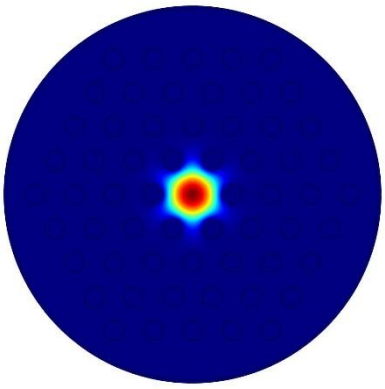
[a]- some diameters presented

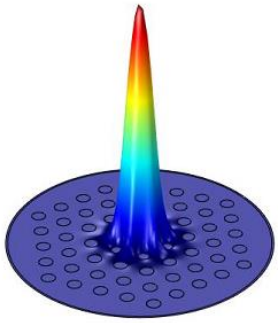


Large Mode Area Photonic Crystal Fibers

- endlessly single-mode operation (no higher-order mode cut-off)
- handles very high average power as well as high peak power
- low nonlinearities
- relatively low fiber loss
- mode field diameter is wavelength independent
- radiation hard
- available with core diameters from 10 to 35 microns

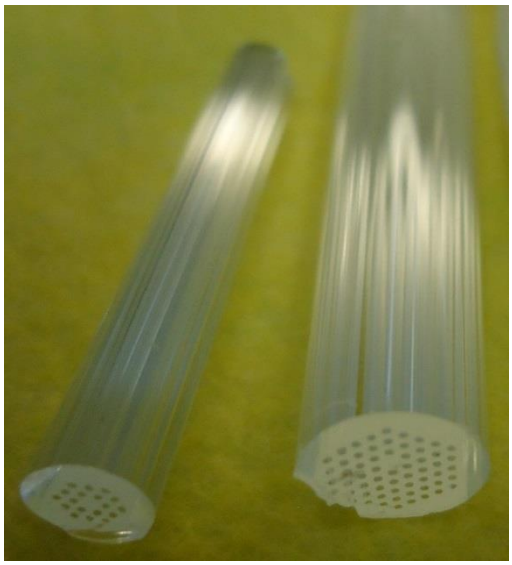






Typical Applications

High-power delivery with excellent beam quality
Multi-wavelength transmission
Mode filtering
Short pulse delivery
Low beam divergence pointing



Single-mode large mode area photonic crystal fibers combine a large effective mode filed area and relatively low loss to allow high average/peak power delivery without nonlinear effects or material damage over long distances.

The fibers are endlessly single-mode (i.e. have no higher-order mode cut-off) and provide excellent beam quality at all wavelengths.

Spectral operation range is only limited by the bend-induced leakage of the fundamental mode at shorter wavelengths which depends on the fiber core diameter.

Optical Characteristics	Core Diameter (μm)					
	10	15	20	25	30	35
Higher-Order Mode Cut-Off (nm)	no	no	no	no	no	no
Attenuation @ 1064 nm (dB/km)	< 5	< 8	< 10	< 20	not operable	not operable
Attenuation @ 1550 nm (dB/km)	< 2	< 3	< 5	< 5	< 10	< 10
Mode Field Diameter @ 1550 nm ($1/e^2$) (μm)	8.0±0.5	12.0±0.5	16.0±0.5	20.0±0.5	23.5±0.5	26.5±0.5
Calculated Numerical Aperture @ 1550 nm ($1/e^2$)	0.123	0.082	0.062	0.049	0.042	0.037
Short Wavelength Edge (nm)*	500	600	800	900	1100	1200
Long Wavelength Edge (nm)*	1700	1700	1700	1700	1700	1700

Physical Characteristics	Core Diameter (μm)					
	10	15	20	25	30	35
Cladding Diameter [μm]	80±5	120±5	160±5	200±5	240±10	280±10
Coating Diameter [μm]	110-140	160-190	200-230	250-300	300-350	400-450
Core and Cladding Material	Pure silica with OH content less than 1ppm					
Coating Material, Single Layer	Acrylate**					
Proof-Test Level, %	0,5 %					

*Bend radius 15.8 cm

**Available high temperature (200 °C) resistant tin coating

High Power Multimode Fiber Optic Cable

- Utilizes Air-Gap-Ferrule Technology
- Low-OH Fiber with 0.22 NA
- Operating Wavelength Range: 400 to 2000 nm
- SMA 905 Style Connectors
- Working Field up to 1.0 mm diameter
- 3.0 mm Outer Diameter PVC or PEEK Protective Tubing
- Polished End Face
- Maximum Power Density: 150 kW/cm2 @ 780 nm
- Operating Temperature: -50 °C to 130 °C
- Length up to 50 meters