



LE VERRE FLUORÉ
INFRARED SOLUTIONS

CATALOG
2017





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Since 1985, Le Verre Fluoré is the undisputed leader of fluoride glass technology. In addition to the definition of the classical ZBLAN glass (1979), it also produced the first fluoroindate glass fibers (1992), the first single mode fluoride fibers, the first laser fibers, and the first polarization maintaining fibers.

For fiber lasers, double core fibers have been developed, and also rectangular and D-shaped core fibers. A variety of rare earth doped fibers have been manufactured, including those with large lanthanide concentrations (up to 10 %).

LVF proposes robust and reliable solutions for industrial applications (spectroscopy, lasers, measurements). We can design and manufacture custom fiber/fiber patch cable including all your requirements (geometry, NA, rare earth concentration, cutoff wavelength,...). We can comply your needs with custom infrared solutions.

LE VERRE FLUORÉ DESIGNS, DEVELOPS, MANUFACTURES AND SUPPLIES:

Low Loss Fluoride Glass IRguide® fibers & cables

Zirconium Fluoride Glass (ZFG) Indium Fluoride Glass (IFG) and Aluminium Fluoride Glass (AFG)

- Operating wavelength: 0,3-4,5 μm to 0,3-5,5 μm
- Fiber types:
 - Multimode
 - Single mode
 - Double clad
 - Rare Earth-doped (up to 100 000 ppm)
 - Polarization-Maintaining
 - Low birefringence
 - On demand core/cladding profile
- Custom IR fiber development

Le Verre Fluoré provides the most transparent fluoride fibers of the market.

IRguide® components & assemblies

- Vis-IR Fiber assemblies
- High fill factor coherent & incoherent IR Fiber bundles
- IR fiber feedthrough; IR flow cell
- Components and Assemblies for Astronomy & Spectrometry:
Dispersion balanced fiber links,
Polarization rotator, Broadband IR coupler, Focal plane dissector, Fiber Optic Delay Line
- Beam combiner
Ex.: FLUOR (Fiber Link Unit for Optical Recombination) installed on Mount Wilson Observatory (CA)

STANDARD FLUORIDE FIBERS



On demand single mode and multimode fibers

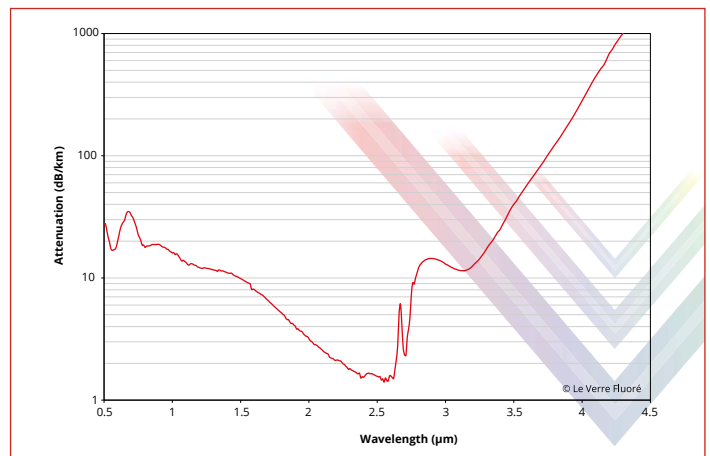
TRANSPARENCY RECORD :

ZFG (ZBLAN) : 0.00104 dB/m at 2.56 μm
(in a 234 m long fiber)

IFG (InF_3 glass) : <0.005 dB/m at 2.5 μm and 3.5 μm

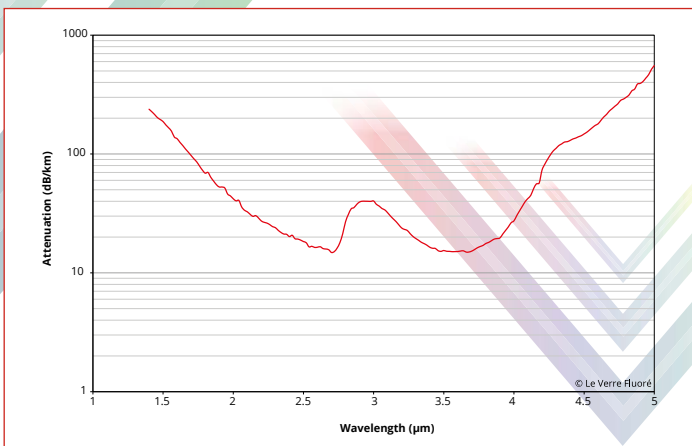
ZFG (ZBLAN) Fluoride Glass fibers

Attenuation	Operating Temperature
$\leq 0,05$ dB/m [0,3 - 3,4 μm] $\leq 0,1$ dB/m [3,4 - 3,6 μm] ≤ 1 dB/m [3,6 - 4,3 μm]	-180°C to 150°C



Typical multimode ZFG fiber attenuation curve

IFG Indium Fluoride Glass fibers



Typical multimode IFG fiber attenuation curve

Attenuation	Operating Temperature
$\leq 0,05$ dB/m [2 - 4.1 μm] $\leq 0,1$ dB/m [1.7 - 4.3 μm] ≤ 1 dB/m [0,3 - 5,3 μm]	-180°C to 150°C

BARE FIBER PRICES

		STANDARD BARE FIBERS			
		Ø core (µm)	Ø clad (µm)	λ _c or NA	Price/m (EXW)
ZFG	Single mode	6.5	125	λ _c = 1.95 µm	80 €
		8.5	125	λ _c = 2.55 µm	110 €
	Multimode	90	150	NA = 0.20	50 €
		200	250	NA = 0.20	80 €
		400	450	NA = 0.20	240 €
IFG	Multimode	130	200	NA = 0.30	100 €
		200	250	NA = 0.20	140 €

LVF provides multimode and single mode fibers

and can customize:

- core/cladding geometry and size
- NA (from 0.08 to 0.35)/cutoff wavelength (from 400 nm to 4 000 nm)
- Rare earth concentrations (Er, Ho, Tm, Pr, Dy, Nd, Sm, Yb, ...): up to 100 000 ppm

SOME CUSTOM SINGLE MODE ZFG FIBERS		
	Specifications	Price/m (EXW)
125 µm doped fiber	Øclad = 125 µm	230 €
Polarization maintaining fiber	Øclad = 125 µm	400 €
250 µm single mode fiber	Øcore / clad = 14 / 250 µm λ _c = 2.2 µm	600 €
Double clad fiber	Øcore / 1st clad / 2nd clad = 14 / 250 / 280 µm λ _c = 2.2 µm	700 €
Er-doped D shape fiber	10 000 ≤ Er ³⁺ ≤ 70 000 ppm Øcore / 1st clad / 2nd clad = 15 / 240x260 / 290 µm	800 €

STANDARD PATCH CABLES



Standard fiber patch cables from 150€

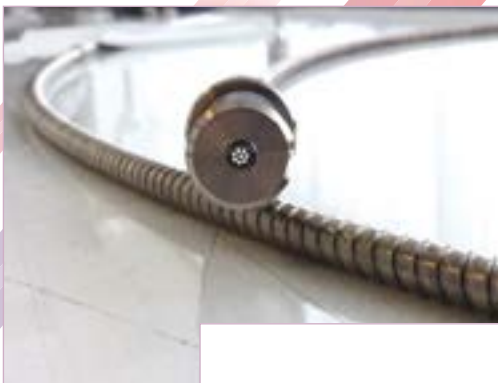
STANDARD FIBER PATCH CABLES						
		Ø core (µm)	Ø clad (µm)	NA	Length	Price/m (EXW)

ZFG	Single mode Jacket : kevlar Connectors : FC/PC or FC/APC	6.5	125	0.23	1 m	210 €
		8.5	125	0.20	50 cm	150 €
	Multimode Jacket : kevlar Connectors : SMA	90	150	0.20	1 m	200 €
		200	250	0.20	1 m	235 €
		400	450	0.20	1 m	424 €
		600	680	0.20	1m	1100 € (Stainless steel jacket)

IFG	Multimode Jacket : kevlar Connectors : SMA	130	200	0.30	1 m	250 €
		200	250	0.20	1 m	295 €
		400	450	0.30	1 m	Coming soon

Custom fiber patch cables and bundles

Since 1985, Le Verre Fluoré has been involved in the most innovative astronomical projects, which require working to the most rigorous specifications for mid-IR transmission. Le Verre Fluoré is proud to be contributing to the understanding of the Universe through the provision of its IR fiber technology.



Linear and round bundles

Garanted for severe conditions :

- low temperatures (down to -170°C)
- high temperatures (up to 1200°C with water cooled endoscope)
- moisture and corrosive environment
- suitable for Space use



SOME LVF FIBERS PERFORMANCES



OUR STAR PRODUCT: Fibers for IR Fiber Laser Generation

Double-clad fibers with rare-earth dopants :

- Concentration up to 70 000 ppm
- Standard and custom core/clad dimensions
- Standard and on-demand NA and cutoff wavelength
- Specially designed shape for laser applications

IR power laser delivery

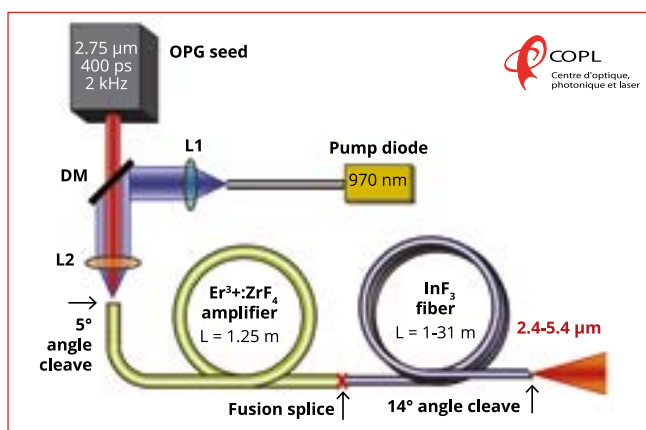
LVF has developed fibers for 2.94 μm and 2.78 μm laser delivery.

- 1.5 J pulses at 2.94 μm
- >> 100 W CW at 2.94 μm

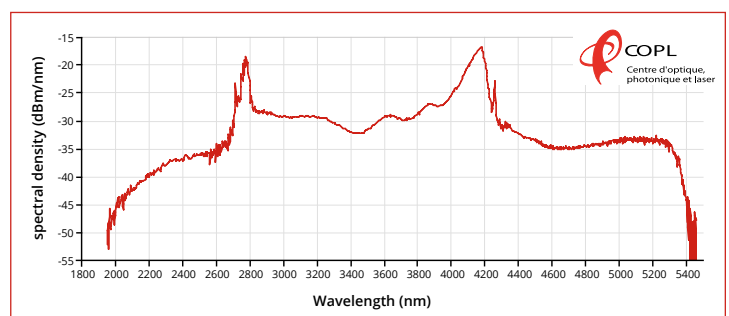
Those fibers, endcapped are designed for industrial uses such as material processing and medical application

5.4 μm record supercontinuum generation

This performance was achieved by COPL with Er-doped double clad ZFG fiber and single mode IFG fiber.



Experimental setup of the IFG-based SC source pumped by an Er³⁺ZFG fiber amplifier



Output specter of InF₃ Supercontinuum

Applications

- Infrared spectrometry
- Infrared countermeasures
- Spectral fingerprinting
- Hyperspectral imaging
- Research and development
- Your application



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