

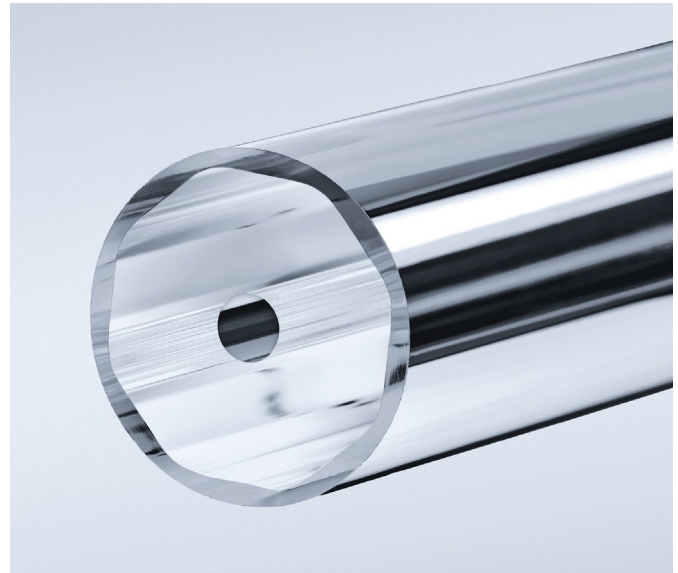
Highly Fluorine Doped Tubes

Heraeus is the key global supplier of high purity synthetic fused silica products for optical fiber manufacturing. We have been a reliable partner in the world telecommunications industry since 1976.

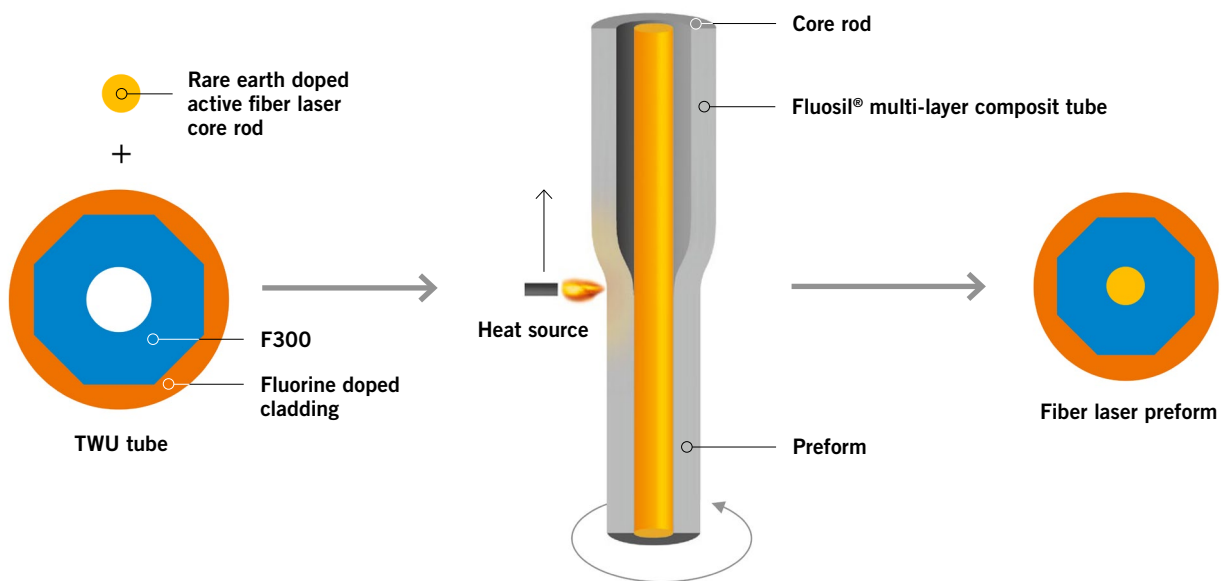
Fluosil® tubes are characterized by the unique high fluorine concentration, which leads to a depressed index of refraction up to -26×10^{-3} . Our Fluosil® tubes feature the highest fluorine content and therefore the lowest refractive index in the market. They can be manufactured as multiple layer composite tubes with a polygonal structure e.g. as pump cladding for fiber laser core rods.

Typical applications include:

- Structured composite tubes to create laser fiber pump claddings
- Fluorine doped capillaries, e.g., for optical and viscosity matching



Overcladding Process



Available tubes

		Composite tubes	
		TWU	TTU
Fluosil® layer	Refractive index*	0 ... -26×10^{-3}	
	OH [ppm] typical	1 ... 30	
	F [ppm]	0 ... 70,000	
Substrate tube	Substrate tube material	F300	F320
	Refractive index*	$0.35 \dots 0.5 \times 10^{-3}$	$-0.6 \dots 1.2 \times 10^{-3}$
	OH [ppm] typical	< 1	< 1
	F [ppm]	–	3,000 ... 4,000

* Difference to un-doped fused silica (Heraeus standard)

Uniformly fluorine doped Fluosil® tubes, referred to as U-types (TWU, TTU), are available. In addition, tubes are available with a double or multi step refractive index profile. These types are referred to as S-types (TWS, TTS).

- Outer tube diameter: 10 ... 40 mm
- Fluorine doped wall thicknesses: 3 ... 15 mm
- Lengths: Up to 1,300 mm
- Other custom geometries available on request

Special tube cross sections

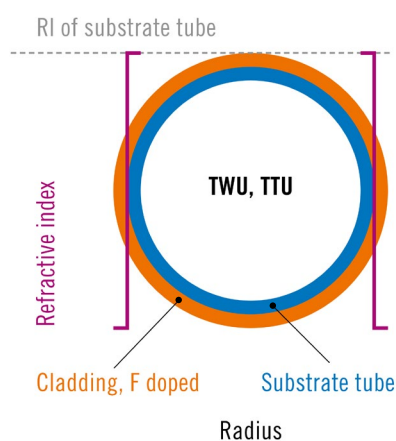
Beyond the standard cylindrical tube geometry, we also offer multi layer Fluosil® tubes with polygonal interface sections such as rectangular, square, hexagonal or octagonal.

Physical Material Characteristics

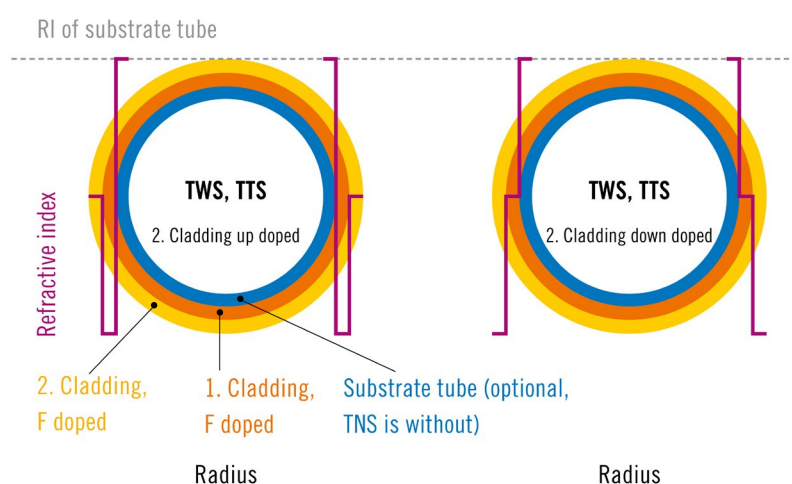
	Un-doped tube	F doped tube*
Refractive index @ 633 nm	1.4571	1.440
Refractive index @ 1,064 nm	1.4498	1.433
Transformation temperature	1,050 °C	750 °C
Fluorine content	0 wt %	5.0 wt %

* Tube with $\Delta n 17.1 \times 10^{-3}$ respectively un-doped fused silica

U-Types – Typical Cross Sections and Refractive Index Profiles



S-Types – Typical Cross Sections and Refractive Index Profiles



HERAEUS COVANTICS HEADQUARTERS

Heraeus Quarzglas GmbH & Co. KG

Heraeusstraße 12–14

63450 Hanau

covantics@heraeus.com

covantics.com/contact

www.heraeus-covantics.com

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