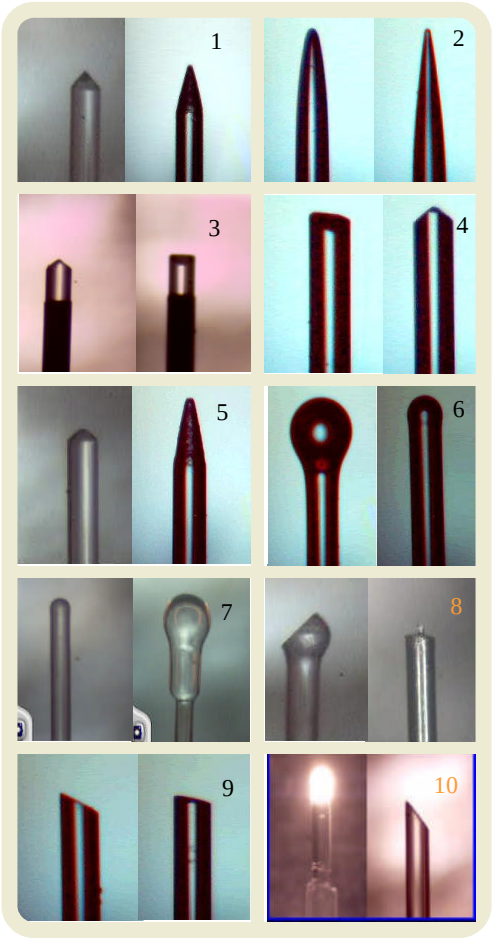
Micro- lensed optical fibers

Features: Single-mode, PM, multimode, double-clad, PCF, POF, IR fibers with/without optical connectors

Shape of the fiber end: **cone** (1). **tapered cone** (2), **wedge**(3), **angled tip wedge** (4), **cone with flat top** (5), **ball** (6), **ball with large working distance** (7), **angled ball with large working distance and integrated metal reflector(8)**, **angle polished** (9), **angle polished with metal reflector** (10)

Fiber length: 0.1-3.0 m



Lensed fiber is produced using different fine lens tip shaping techniques.

Each micro-lens characterized using: far optical field and near optical field analysis, return loss, working distance measurements and geometrical measurements

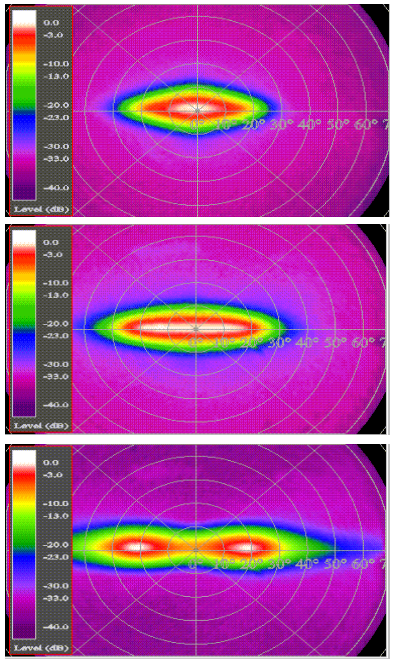
Shape of the lens (radius of curvature) can be set between 3 to 500 μm.

Micro-lensed fiber can be characterized

at different wavelengths:
405, 677, 860, 980, 1300 -2000 nm.
(Far optical field;
Optional: Near optical field,
working distance scan; back-reflection)

Manufacturing cycle: 1-3 weeks
Discount for quantity orders

The shape of the lens is controlled in one or both planes to match FWHM of the source

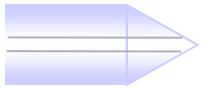
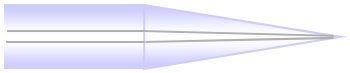
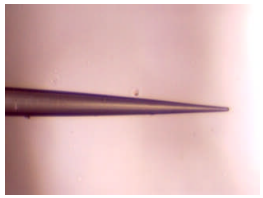
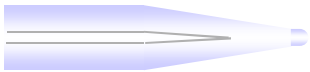


Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

WT&T Inc.

Cone and tapered cone lensed fiber

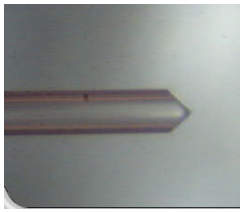
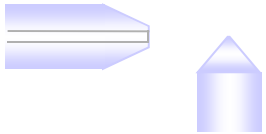
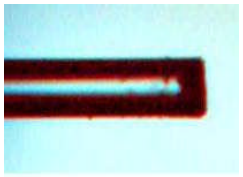
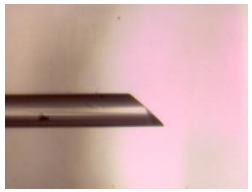
Cone lensed optical fibers provides focusing of light into tight spot near fiber tip and it increases divergence of light from single mode fibers

CL1	Cone lensed 		Coupling of light from/to O/E devices and PLC	Far optical field divergence of light from the lensed fiber tip (FWHM) can be set between 7 to 50 Deg. Focused optical spot size ~2-7 um. Lens working distance~5-5-15 um
CL2	Cone with flat top 		Optical sensors in liquids, F/O microphones, etc.	Far optical field divergence is the same as from un-processed fiber. Fiber tip can be flat or angle-polished
CL4	Long tapered 		Optical sensors in liquids, formation of “point source”, reduction of optical spot diameter in mm fibers.	Fiber tip can be flat or micro-lensed. For multi-mode fibers optical field diameter can be reduced by up to ~10-20 times
CL5	Tapered cone with spacer 		Coupling of light from/to O/E devices and PLC, optical sensing, where long working distance and small spot size are important.	Far optical field divergence of light from the lensed fiber tip (FWHM) can be set between 10 to 40 Deg. Focused optical spot size ~1-3 um. Lens working distance ~15-50 um

Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

Wedge lensed fiber

Wedge lensed optical fibers provides focusing of light into tight spot in one direction

WL1	Wedge lensed		Coupling of light from/to laser diodes and PLC, portable spectrometers	Far optical field divergence of light from the lensed fiber tip (FWHM) in one direction can be set between 7 to 45 Deg. Optical field aspect ratio up to 1:6 Lens working distance~5-15 um
WL2	Chisel lensed 		Coupling of light from/to laser diodes, sLED, SOA and PLC	Far optical field divergence for fast axis can be set between 7 to 40 Deg. Optical field aspect ratio up to 1:4 Lens working distance~5-15 um
WL-A	Wedge with angled tip		Coupling of light from/to sLED, SOA and PLC	Fiber tip angle can be set btw 0 to 20 Deg to accommodate SLED/ SOA chip tilted waveguide geometry Optical field – elliptical with aspect ratio up to 1:5
AF	Angle- polished fiber 		Coupling of light from/to O/E devices and PLC, optical sensing, illumination ,where changing direction of light, emitted from the fiber is important.	Introduction of angled interface in the light-pass results in deflection of light, emitting from the fiber. Resultant deflected optical field is becoming slightly elliptical.

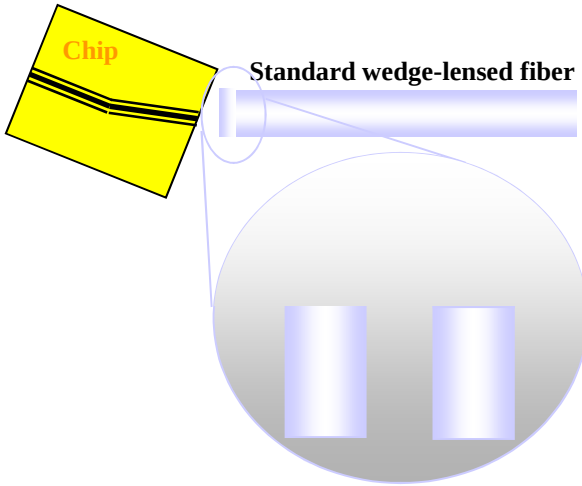
Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

WT&T Inc.

Angled wedge lenses

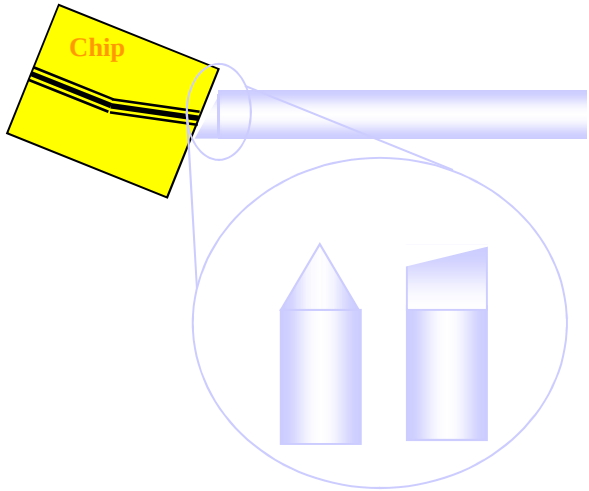
Specially designed for efficient light coupling between angle-stripe semiconductor structures (SOA, SLED, etc.) and single mode fiber.

Standard wedge lens



- Rectangular geometry of the standard wedge lens does not fit to an angled chip facet
- Alignment of the fiber to the chip is difficult and coupling efficiency might suffer
- AR coating required to further reduce back-reflections from the lensed fiber

Angled end wedge lens



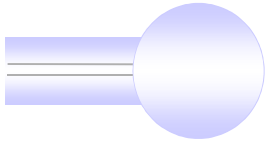
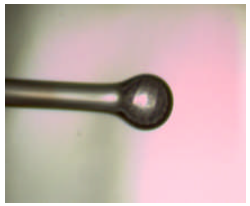
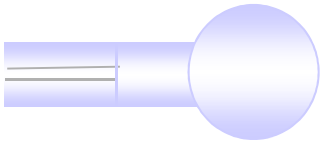
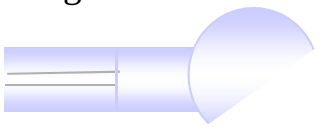
- Angled geometry of the wedge lens provides access to an angled chip facet
- Alignment of the fiber to the chip is simpler and coupling efficiency is increased
- Choosing proper angle of the wedge tip can improve coupling efficiency and reduce back-reflections from the lensed fiber

Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

WT&T Inc.

Ball lensed fiber

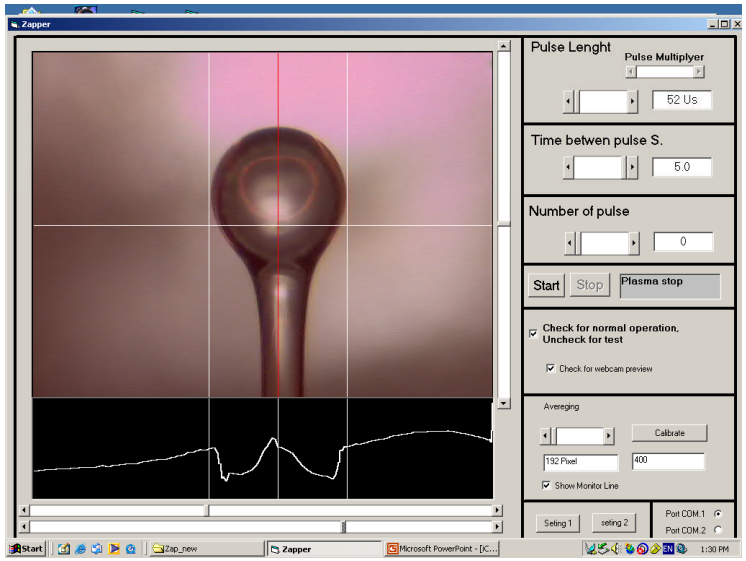
Wedge lensed optical fibers provides focusing of light into tight spot in one direction

BL-1	Hemispherical lensed		Optical sensors, hydrophones, various optical probes	This lens does not change much light divergence, but can provides significant reduction of back-reflected light and acoustic resonance frequency of fiber tip.
BL-4	Ball with short WD 		Coupling of light from/to opto-electronic components, PLC, optical benches. Optical sensing, CMM probes	Ball lens can provide some reduction of optical field divergence and focusing of light into spot @WD Lens working distance~-30-150 um
BL-5	Ball with long WD 		Coupling of light from/to opto-electronic components, PLC, optical benches, OCT Optical sensing, CMM probes	This lens can provide significant reduction of optical field divergence and can be used in micro-collimators. Focusing of light into small spot at working distance of ~200 -3000 um
BL-AF	Angled ball 		Coupling of light from/to O/E devices and PLC, OCT, optical sensing, illumination ,where changing direction of light, emitted from the fiber is important.	Introduction of angled interface in the light-pass results in deflection of light, emitting from the fiber. Resultant deflected optical field is Focused at working distance of 0.4-2 mm

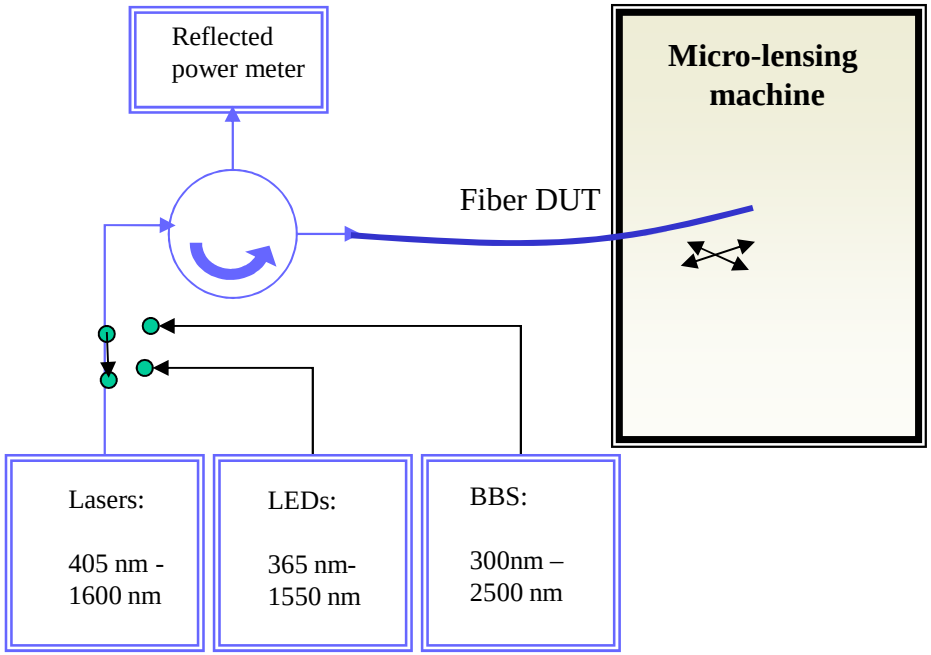
Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

Lensed fibers testing : Lens geometry and back-reflected light measurements

Fiber tip geometry measurements



Fiber optical performance measurements (including BR)



Micro-lensed fiber tip geometry and level of back-reflected (from the lensed fiber tip) light are monitored during manufacturing cycle

Different fiber-coupled light sources, operating in wavelength range of 300-2500 nm are used for characterization of processed fibers.

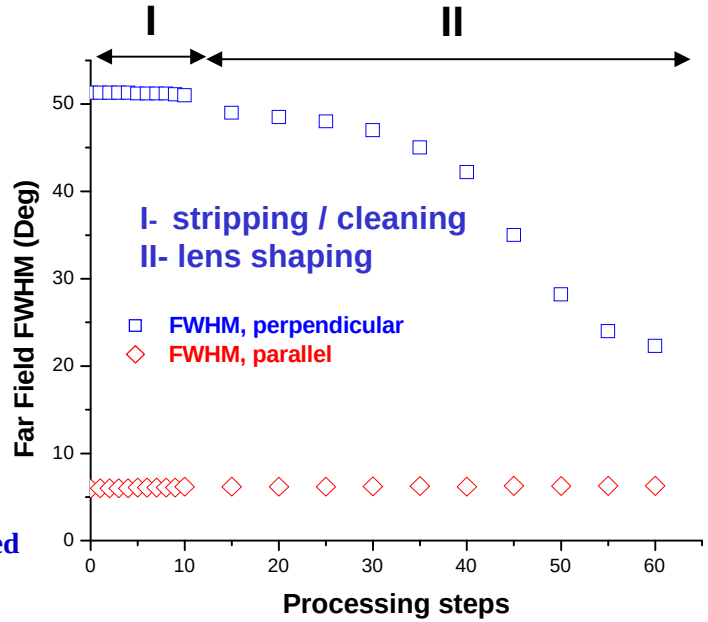
Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

WT&T Inc.

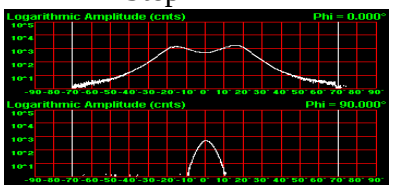
Lensed fibers testing: Far Optical field monitoring

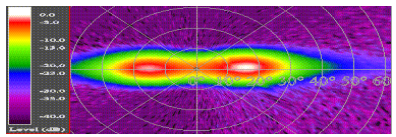
- Our manufacturing process is based on setting Far field divergence of each fiber lens individually (to match the field divergence measured for semiconductor chip)
- This provides high production yield
- Each lens is characterized

An example of Far Field shaping for wedge lensed sm fiber is shown below. First, lensed fiber pre-form is made using high-speed dry polishing, then fiber lens finally shaped.



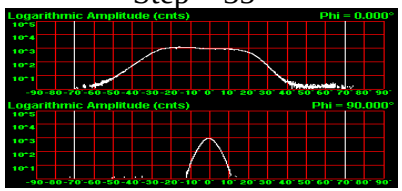
Step + 1

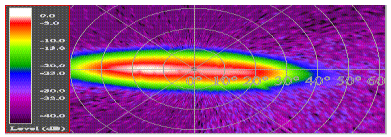




51º x 6.2º

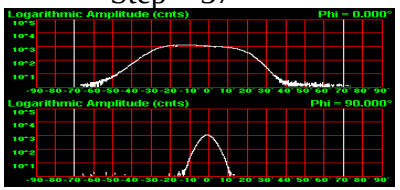
Step + 35

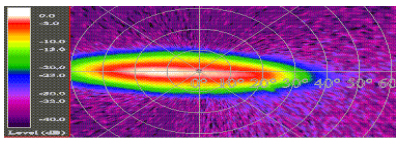




45.7º x 6.2º

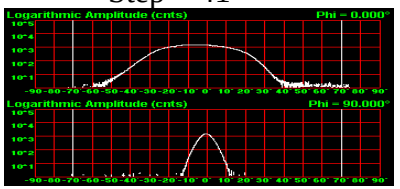
Step + 37

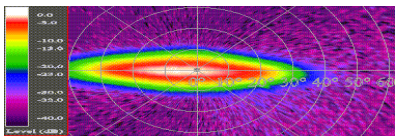




42.3º x 6.24º

Step + 41



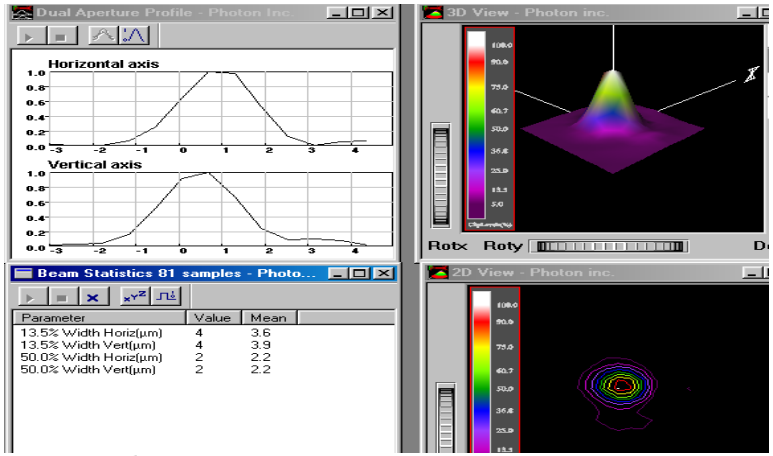


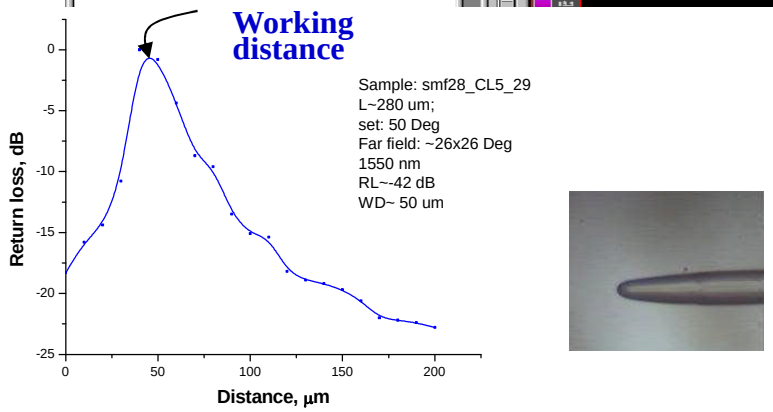
36.9º x 6.26º

Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

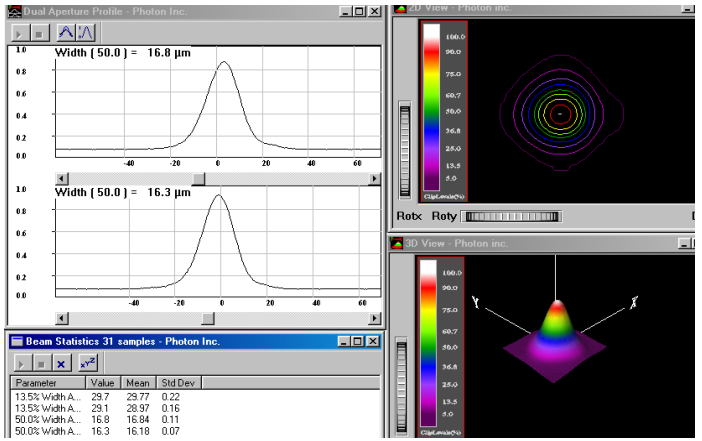
WT&T Inc.

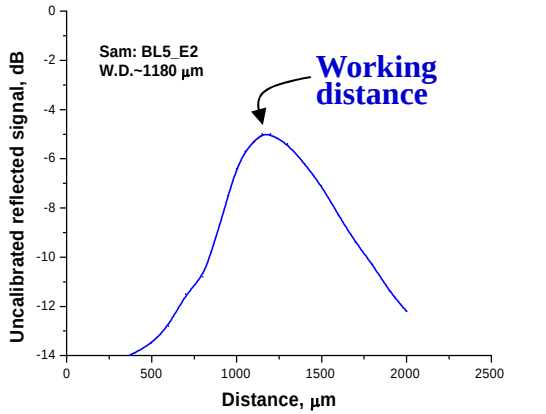
Lensed fibers testing : Spot size and working distance monitoring





Working distance scan and spot size at WD for short working distance lens. Focused light spot size (~2 um) has been measured at WD~50 um using x25 magnification optics





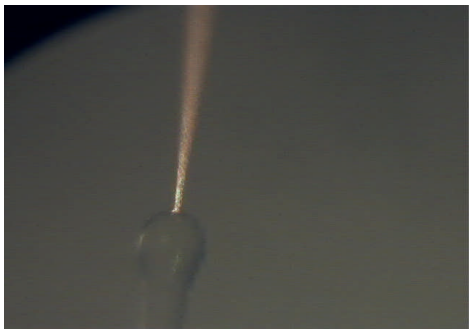
Working distance scan and spot size at WD for long working distance lens Focused light spot size (~16 um) has been measured at WD~1200 um without additional optics

Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

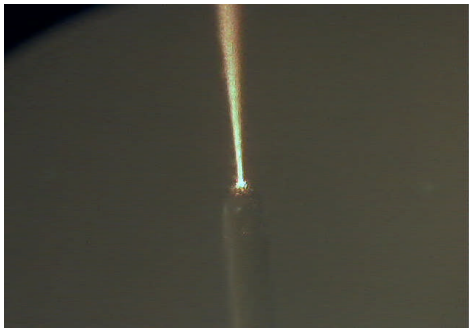
WT&T Inc.

Lensed fibers testing : beam tracing in liquids

single-mode fiber



Ball lens

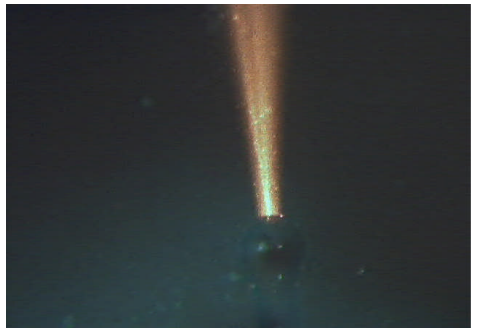


Cone lens

Cone lens

multi-mode fiber

Ball lens



Ball lens

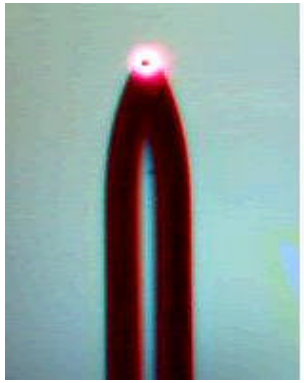
Cone lens

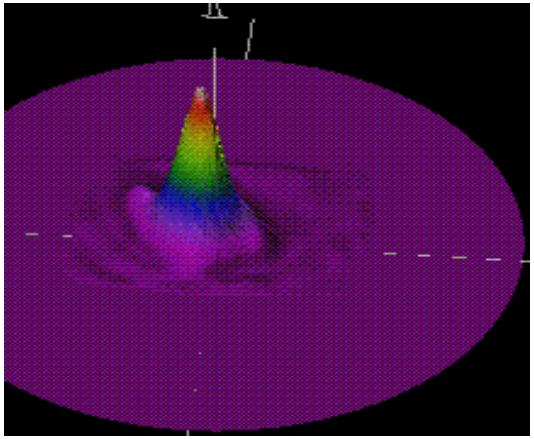
Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

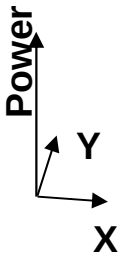
Reduction of scattered light

Careful processing helps to reduce residual light scatter and level of back-reflected light from lensed fiber.

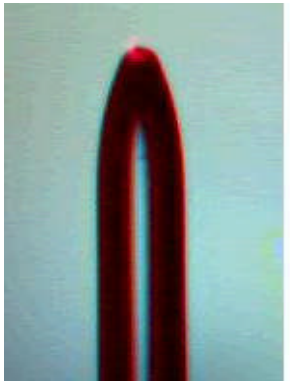
Before

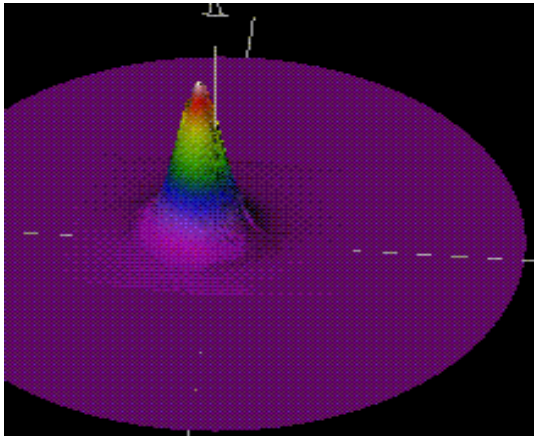






After processing





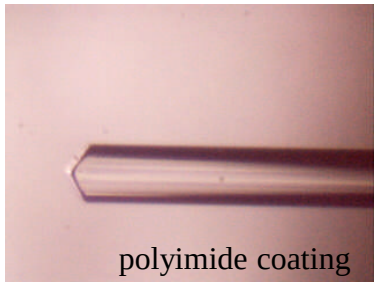
Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

WT&T Inc.

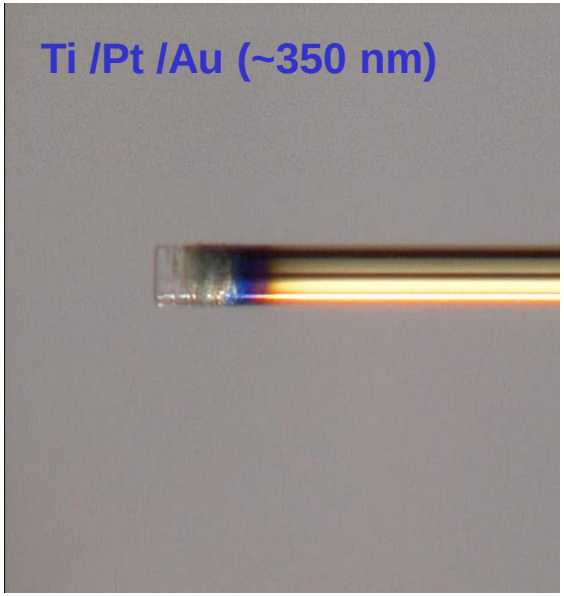
Local removal of coating and metallization from the fiber

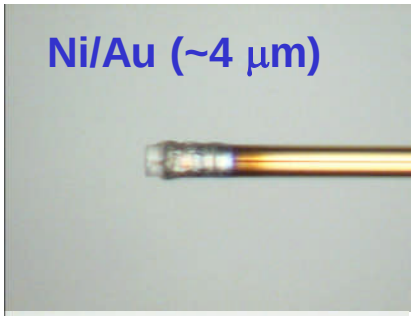
Soft / hard coating and metallization can be locally removed without damaging the fiber.
Metal thickness can be up to 5 μm. Micro- lens can be manufactured on the fiber tip in close proximity to coating or metallized area

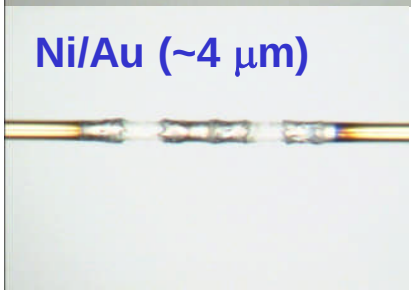
Coating removal



Metallization removal







Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

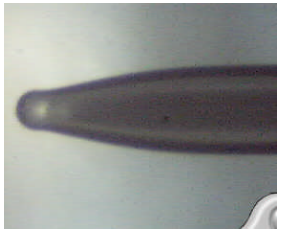
WT&T Inc.

Processing specialty fibers

PM Photonic-crystal fiber

Sealing

Splicing

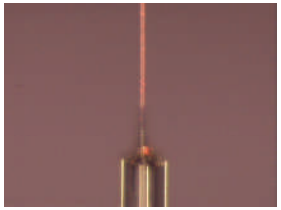


Tapering/
micro-lensing

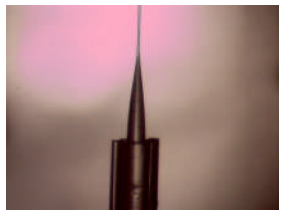
Ball-lensing

Infrared, doped and large core size fibers

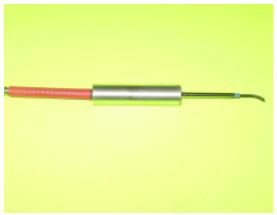
Lensing



Etching



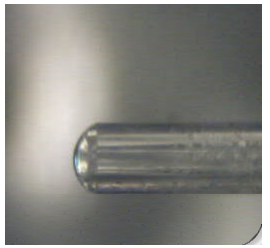
Tapering



Micro-bending

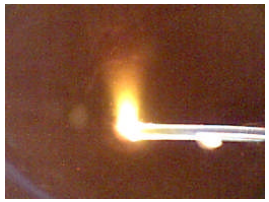
Plastic fibers

Cone-lensing



Ball-lensing

Tapering/
micro-lensing



Angle-
polishing

Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

WT&T Inc.

Custom design

WT&T is offering great flexibility in lensed fiber assemblies design options. Many parameters, including lens or fiber type, fiber length, protection, termination , operating temperatures etc can be specified to ensure good system performance. Our company will process small or medium size orders in time. Also we will be willing to work with Customer provided optical fibers.

When you communicate with WT&T regarding lensed fibers, please provide following information:

- Describe your application (if possible, provide simple drawings of required assembly)
- Required type and length of optical fiber
- Operating wavelength, optical power and temperature range
- Required working distance and output light divergence (or focused spot size)
- Type of fiber termination (optical connector, ferrule, V-grove, cleaved fiber e.t.c)
- Fiber protection and required assembly flexibility
- Special testing requirements
- Quantity and delivery time

Tel:+1(514)804 0822
E-mail: sales@wttechnology.com
www.wttechnology.com

WT&T Inc.