

# CS980 Reduced-cladding Coupler Fibre

Wang Zhendong, Yang Chen, Liu Yang, Liu Qi, Wu Qin, Wang Song, Tong Weijun

**Abstract:** CS980 reduced-cladding coupler fibre is mainly used for fabricating the 980nm pump light source pigtail and the 980/1550 wavelength division multiplexing coupler located at the front/back end of the erbium-doped fibre in the erbium-doped fibre amplifier (EDFA) system. In order to meet the market demand for small-size couplers, YOFC has launched CS980 reduced-cladding coupler fibre. In addition to its reduced cladding, this optical fibre also shows such advantages as low additional loss of tapering and high isolation.

**Key words:** Coupler fibre, tapering, reduced cladding, bending insensitive

## 1 Introduction

With the development of technology, miniaturization of devices has gradually become a prevailing trend. In order to meet the market demand for Mini-Coupler, Yangtze Optical Fibre and Cable Joint Stock Limited Company (hereinafter referred to as "YOFC"; Stock Code: 6869.HK) specially launched CS980 reduced-cladding coupler fibre. CS980 reduced-cladding coupler fibre is mainly used for fabricating the 980nm pump light source pigtail and the 980/1550 wavelength division multiplexing (WDM) coupler at the front/back end of the erbium-doped fibre (EDF) in the erbium-doped fibre amplifier (EDFA) system. Compared with the original coupler fibre, in addition to excellent bending insensitiveness and tapering performance, the cladding diameter of the optical fibre decreases from 125  $\mu\text{m}$  to 80  $\mu\text{m}$  and the fibre diameter decreases from 250  $\mu\text{m}$  to 165  $\mu\text{m}$ , with the fibre diameter being decreased by more than 30%. In the verification of fused biconical taper, the optical fibre shows the advantages of low additional loss of tapering and high isolation.

## 2 Introduction to Basic Performance of CS980 Reduced-cladding Coupler Fibre

Starting with waveguide design and brand-new

material design, YOFC has developed CS980 reduced-cladding coupler fibre with the aim of reducing the cladding and improving the geometrical stability, bending performance and tapering performance of the optical fibre. The optical fibre has excellent macro-bending performance and low additional loss of tapering in the operating wavelength.

Detailed technical specifications of the optical fibre are shown in the following table:

Table 1 Key Parameters of Reduced-cladding Coupler Fibre

Type of Optical Fibre	CS980 Reduced-cladding Coupler Fibre of YOFC	CS980 Reduced-cladding Coupler Fibre of International Competitors
Operating wavelength (nm)	980/1550	980/1550
Mode field diameter ( $\mu\text{m}$ )	4.0 $\pm$ 0.5@980nm 6.4 $\pm$ 0.7@1550nm	4.0 $\pm$ 0.5@980nm

Cutoff wavelength (nm)	920±50	≤ 970
Loss (dB/km)	≤2.5 @980nm ≤1.0 @1550nm	≤3.5 @980nm /
Macro bending Loss(dB)	≤0.01 @980&1550nm (20mm/turn)	/
Typical numerical aperture	0.20	0.20
core diameter (μm)	3.6	3.6
Cladding diameter (μm)	80±1	80±1
Coating diameter (μm)	165±10	165±10
Core/Cladding concentricity (μm)	≤0.3	≤0.3
Loss of tapering(dB)	≤0.1	/
Proof test level (kpsi)	00 or 200	100

YOFC CS980 reduced-cladding coupler fibre has the follow advantages:

(1) The geometrical characteristics of CS980 reduced-cladding coupler fibre are optimized, and the cladding diameter is controlled within  $80 \pm 1 \mu\text{m}$ . At the same time, in order to achieve better tapering effect, the typical value of core/cladding concentricity is less than  $0.2 \mu\text{m}$ .

(2) YOFC CS980 reduced-cladding coupler fibre has excellent macro-bending performance:  $\phi 20 \text{ mm} \times 1 \text{ turn @ } 980 \text{ nm}$  loss  $\leq 0.01 \text{ dB}$ ,  $\phi 20 \text{ mm} \times 1 \text{ turn @ } 1550 \text{ nm}$  loss  $\leq 0.01 \text{ dB}$ , which can meet the

requirements for being used in miniaturized devices.

(3) YOFC CS980 reduced-cladding coupler fibre has high compatibility with other optical fibres. The loss of splicing is about 0.05dB with a foreign famous brand 980-20 optical fibre and about 0.25 dB with YOFC G652D optical fibre.

Table 2 Splicing Loss of YOFC CS980 Reduced-cladding Coupler Fibre with Other Optical Fibres

Type of spliced optical fibre	A famous foreign brand reduced-cladding 980-20		G652D
Wavelength (nm)	980	1550	1550
Splicing loss (dB)	0.05	0.05	0.25

### 3 Tapering Performance of CS980 Reduced-cladding Coupler Fibre

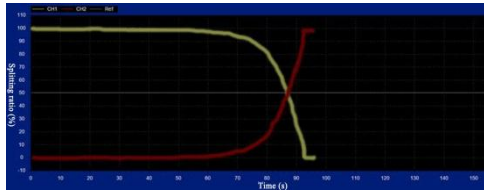
Material defects and waveguide structure changes will cause the loss of optical power in optical fibre during fused biconical tapering. Therefore, the data of optical power loss and optical power stability can be used to directly evaluate whether the optical fibre is suitable for fused fibre devices in the test of single fibre tapering. The optical power and loss in the fibre during tapering can be measured in real time by the power detector of the tapering machine.

A 980nm single-mode pump light source and a 1550nm single-mode pump light source are used in the test. The tapering speed is  $140 \mu\text{m/s}$ , the flow rate of  $\text{H}_2$  is 150ml/min, the flow rate of  $\text{O}_2$  is 7ml/min, and the coupling period is 0 (i.e., the tapering of single optical fibre). Figure 1 shows a splitting ratio-time curve obtained through tapering of a YOFC CS980 reduced-cladding coupler fibre. It records the variation of the splitting ratio with time from the start of tapering until the preset splitting ratio is reached. Throughout the test, the loss fluctuation of YOFC



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CS980 reduced-cladding coupler fibre is small, the curve is gentle, and the loss is always lower than 0.1 dB.



**Figure 1.** The optical power curve when producing 980/1550 WDM

(The yellow line in the figure stands for the splitting ratio of 980 nm and the red line stands for the splitting ratio of 1550 nm)

As one of the most basic components of optical passive devices, WDM has been widely used in wavelength division multiplexing optical fibre communication systems. Because of its simple operation and low price, tapering has become a common manufacturing method for WDM. In order to further verify the performance of YOFC CS980 reduced-cladding coupler fibre, the fibre is tapered into WDM and then tested. The data of measured splitting ratio and isolation degree are shown in the following table:

Table 3 Performance of WDM Manufactured through Tapering of YOFC CS980 Reduced-cladding

Coupler Fibre

YOFC Reduced-cladding Coupler Fibre (CS980/80-20/165)						
No.	Splitting Ratio CR (%)		Isolation ISO (dB)		Tapering Loss (dB)	
	1550nm	980nm	1550nm	980nm	1550nm	980nm
1	99.92	0.35	30.75	24.48	≤0.1	≤0.1
2	99.95	0.19	32.8	26.9		
3	99.96	0.2	34.5	27.1		
4	99.95	0.19	33.5	27.7		
Average	99.95	0.23	32.89	26.55	≤0.1	≤0.1

To sum up, YOFC CS980 reduced-cladding coupler fibre can meet the requirements of development and design, and has good geometrical index, bending performance, splicing performance, and tapering performance. It can meet the requirements of tapering device for optical fibre, and its performance surpasses the foreign products of the same kind.

Appendix

As for optical fibres which can be tapered for WDM, the following series of sub-models of YOFC can also be selected. They all have low tapering loss (≤ 0.1dB) and can meet the requirements of different operating wavelengths and different types of devices.

Table 4 YOFC Coupler Fibre Series

Type of Optical Fibre	CS980/12-5-22/250	CS980/125-20/250	CS980/125-16/250	CS1310/125-16/250
Product Number	CS1015-C	CS1015-B	CS1015-A	CS1011-A

Operating wavelength (nm)	>970	>970	>970	>1300
Mode field diameter (μm)	4.0±0.3@980nm	4.0±0.5@980nm	5.0±0.5@980nm	6.0±0.5@1310nm
Cutoff wavelength (nm)	920±50	920±50	920±50	1200±50

Loss (dB/km)	$\leq 2.5$ @980nm	$\leq 2.5$ @980nm	$\leq 2.5$ @980nm	$\leq 1.0$ @1310nm
	$\leq 1.0$ @1550nm	$\leq 1.0$ @1550nm	$\leq 1.0$ @1550nm	$\leq 1.0$ @1550nm

## 长飞光纤光缆股份有限公司

Yangtze Optical Fibre and Cable Joint Stock Limited Company

地址：武汉市光谷大道9号（430073）

ADD: No.9 Optics Valley Avenue, Wuhan, Hubei,  
China(P.C.: 430073)

电话(Tel): +86 400-991-6698

邮箱(Email): [marketing@yofc.com](mailto:marketing@yofc.com)

[www.yofc.com](http://www.yofc.com)