YOFC HiBand GIMM Fibre

Description

YOFC HiBand GIMM fibre is designed specifically for high speed local area network (LAN) such as Gigabit or higher speeds Ethernet. With the extremely refined refractive index profile owing to the optimized PCVD process, YOFC HiBand GIMM fibre eliminates the differential mode delay (DMD) phenomenon observed on the conventional GIMM fibres in Gigabit applications. Thus, there is no need for expensive DMD compensation. HiBand fibres satisfy the use at 850 nm and 1300 nm. The maximum link distances (up to 2000 m) for Gigabit Ethernet system are the longest distances available in the world. Two types of HiBand fibres are available: 50/125 μm and 62.5/125 μm

Application

The outstanding optical performance of HiBand fibres makes it suitable for applications including not only high speed LAN but also lower bit-rate systems such as FDDI, Ethernet, ATM, etc. The link distance of HiBand fibres is well above 2000 m for lower bit-rate systems. A wide variety of light sources can be used in combination with HiBand fibres, such as LEDs, 850 nm VCSELs, 780 nm CD lasers and 1300 nm Fabry-Perot lasers.

HiBand fibre is applicable in all cable types including ribbon cable, loose tube stranded cable, slotted core cable, unitube cable and tight-buffer cable.

Norms

YOFC HiBand fibre complies with or exceeds ITU Recommendation G.651 and IEC793-2 type A_{1b} Optical Fibre Specification .

Process and Coating

YOFC fibres are manufactured using the advanced Plasma Activated Chemical Vapor Deposition (PCVD) process. Because of the inherent advantages of the process, YOFC fibres show extremely refined refractive index (RI) profile control, excellent geometrical performance, low attenuation, etc .

The optical fibre is coated with a double layer UV curable acrylate, type DLPC9, which gives the fibre a good protection. Designed for more stringent tight-buffer cable application, the fibre also performs perfectly in loose buffer constructions and demonstrates a high resistance to micro-bending. The coating offers an excellent stable coating strip force over a wide range of environmental conditions and the coating stripping leaves no residues on the bare glass fibre. Ribbon tests show excellent performance in 60°C watersoak tests, exceeding 100 days. The DLPC9 coated optical fibres show high and stable values for dynamic stress corrosion susceptibility parameter (n_d), which offers a greatly improved applicability to the fibre when used in harsh environments.

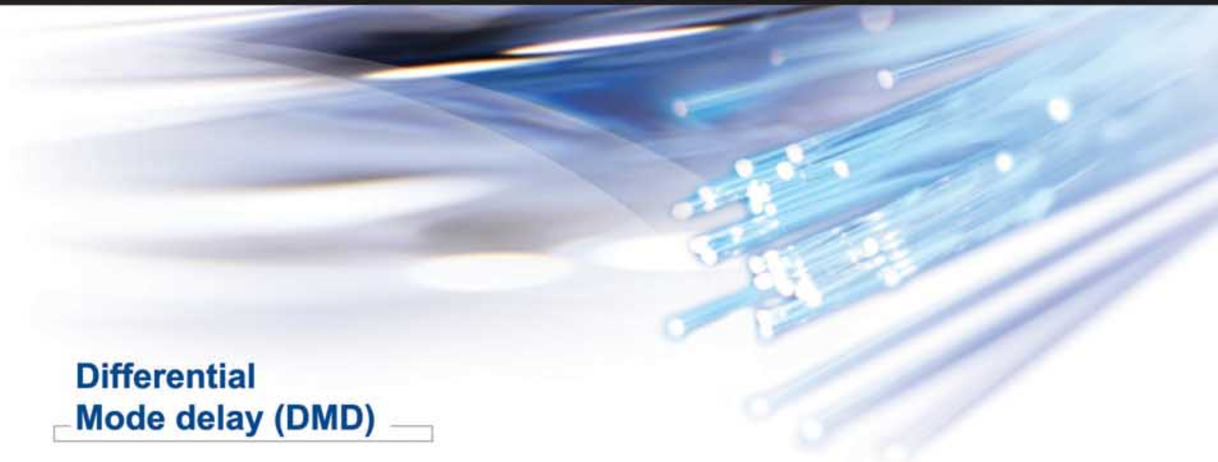
Characteristics

- Designed for use at 850 nm and 1300 nm
- Suited to applications in Gigabit Ethernet and higher bit-rate systems
- No need to use expensive DMD compensation in Gigabit Ethernet
- Enabling the longest link distances compared with congener products
- DLPC9 coating offering good protection and excellent strip force stability

PI：YOFC-MDT-118E-04
Issue date：01/2004
Supersedes：04/2002

HiBand Fibre

Characteristics	Conditions	Specified Values			Units
Optical characteristics		50 μm	62.5 μm	50 μm and 62.5 μm	
Attenuation	850 nm	≤2.5	≤3.0		[dB/km]
	1300 nm	≤0.7	≤0.7		[dB/km]
Fibre capacity	Gigabit ethernet	SX (850 nm)	LX (1300 nm)		
	Standard 50 μm	550	550		[m]
	Standard 62.5 μm	275	550		[m]
	HiBand 50 μm	750	2000		[m]
	HiBand 62.5 μm	500	1000		[m]
Numerical Aperture (NA)	850 nm	0.200±0.015	0.275±0.015		
Group index of refraction (Typical)	1300 nm	1.482	1.496		
		1.477	1.491		
Backscatter characteristics	1300 nm				
Step (mean of bidirectional, measurement)				≤0.10	[dB]
Irregularities over fibre length and point discontinuity				≤0.10	[dB]
Difference backscatter coefficient (bidirectional measurement)		≤0.08	≤0.10		[dB/km]
Geometrical characteristics					
Core diameter		50±2.5	62.5±2.5		[μm]
Cladding diameter				125.0±1.0	[μm]
Cladding non-circularity				≤1.0	[%]
Coating diameter				242±7	[μm]
Coating/cladding concentricity error				≤12.0	[μm]
Coating non-circularity				≤6.0	[%]
Core/cladding concentricity error				≤1.5	[μm]
Delivery length		Standard delivery lengths up to 8.8 km/reel			
Environmental characteristics	850 nm, 1300 nm				
Temperature dependence					
Induced attenuation	-60℃ to +85℃			≤0.10	[dB/km]
Temperature-humidity cycling					
Induced attenuation	-10℃ to +85℃, 90% R.H.			≤0.20	[dB/km]
Damp heat dependence					
Induced attenuation	85℃, 85% R.H., 30 days			≤0.20	[dB/km]
Watersoak dependence					
Induced attenuation	20℃ for 30 days			≤0.20	[dB/km]
Mechanical characteristics					
Proof test	off line			≥9.0	[N]
				≥1.0	[%]
				≥100	[KPSI]
Bending Dependence	850 nm, 1300 nm				
Induced Attenuation	100 turns, 75 mm diameter			≤0.50	[dB]
Coating strip force	typical average force			1.7	[N]
	peak force		≥1.3	≤8.9	[N]
Dynamic stress corrosion susceptibility parameter (n_d, Typical)				≥27	



Differential Mode delay (DMD)

During the development of Gigabit Ethernet, experts observed strong differential mode delay (DMD) effects in a small number of GIMM fibres. Fig. 1 illustrates a distorted pulse where a portion of the detected power from certain mode groups arrives with additional delay, causing a plateau in the output pulse which scales with the fibre length. Such a pulse distortion introduces a high bit-error-rate (BER).

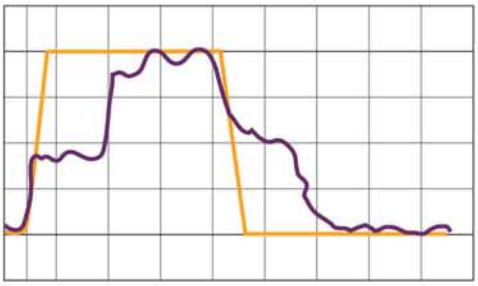


Fig.1.Example of distorted pulse due to DMD

Investigation showed that these fibres exhibit distortions in the central part of the core refractive index profile, and so deviate from the ideal profile. These distortions may originate in certain fibre production processes or under certain uncontrolled process conditions. Some refractive index profile examples of non-PCVD fibres are shown in Fig.2 Local profile distortions may cause DMD for some modes when launched. An extraordinary accurate graded-index profile is needed in order to match the delay time of all launched modes in high speed systems.

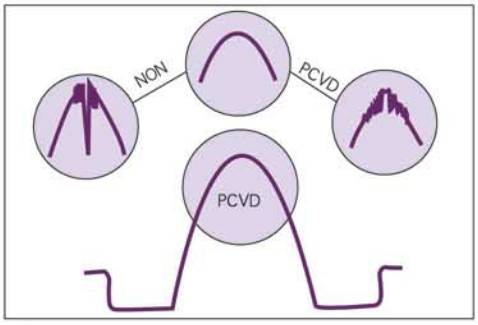


Fig.2.Typical refractive index profile of PCVD Gimmfibre and some example of non-PCVD fibre central core profile distortions (dip/flat top/peak)

Common solution to DMD

For Gigabit Ethernet Standard, a solution must be found to DMD effects. For 1300 nm application, a solution was found by using a special mode-conditioning patch cord. Using this patch cord, the laser source is coupled with a single-mode fibre which is offset spliced to the center of a GIMM fibre (about 17-23 μm for 62.5/125 μm fibre). In this case, the launch power of modes with different delay in the center of GIMM fibres is greatly reduced. However, the solution will not only induce attenuation but also increase the cost of the system due to the expensive module. Are there any more economic and more efficient solutions? HiBand fibre, the achievement of the strenuous efforts of research staff, is just the answer.

HiBand fibre -The better solution to DMD

Fibres made with PCVD process possess the highest profile accuracy. Typically, several thousands of layers are deposited in the core region. By comparison, other fibre processes deposit only hundreds of core layers. Thus, PCVD process can produce ideal profile. To enhance the fibre quality in the laser-based Gigabit or higher speeds systems. YOFC is introducing a new class of high performance PCVD GIMM fibres: HiBand fibres.

In the early 1980s, a patented etching process was developed for the PCVD process to remove the central dip in the core profiie. This enables GIMM fibres to obtain high bandwidth. Thanks to the absence of central core distortion. HiBand fibres do not require the use of expensive mode-conditioning patch cords. This money-saving feature has been confirmed in a series of comprehensive system tests.

Furthermore, in order to satisfy various demands, HiBand quality is available in 50/125 μm and 62.5/125 μm diameter fibres. The 50/125 μm type includes a dual window (850 nm and 1300 nm) optimized version. Fig. 3 shows two wave-length optimization and 1300 nm optimization.

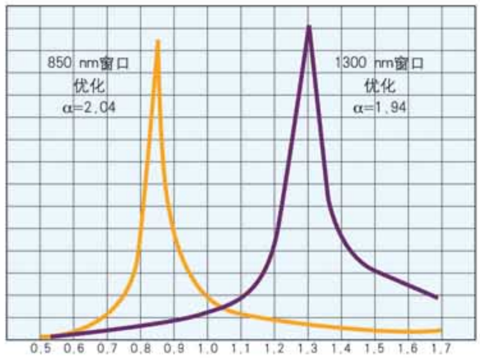


Fig.3.Example for optimization at 850 nm and 1300 nm

Link distance instead of bandwidth

HiBand fibres are not defined in terms of bandwidth but in terms of link distance for Gigabit Ethernet applications. This is because the traditional bandwidth does not entirely describe the fibre behaviour under laser launch conditions. The Gigabit Ethernet link distances of HiBand fibre are the longest reported in the industry.

Future upgradability

Demonstrated by tests, HiBand fibres not only suit Gigabit systems but also can transmit over hundreds of meters at 2.5 Gb/s or higher speeds. Thereby, HiBand fibres facilitate users to upgrade systems in economic and operational way.