

Chief Scientist Reveals

How YOFC's Specialty Optical Fibres Contributes to High-Quality Development of Optical Communication Networks



During the 24th China International Optoelectronic Expo (CIOE 2023) , **Yang Chen, Chief Scientist of Specialty Optical Fibres from Yangtze Optical Fibre and Cable Joint Stock Limited Company (YOFC)** delivered a keynote speech titled "Specialty Optical Fibre Product Solutions for Optical Communication and Data Center Applications" at the Data Center Optical Interconnection Evolution Trends Forum. Yang emphasized, "As a leading enterprise in the optical communication industry, YOFC has leveraged its robust specialty optical fibre manufacturing technology and a whole-process management platform involving R&D, design, production,

inspection, and testing to strengthen its presence in specialty optical fibres and cables. As a provider of solutions for pipeline transmission, optical amplification systems, data centers, optical transceivers, and special application scenarios, YOFC becomes an important contributor to the high-quality construction of communication networks and data centers."

As the Internet business is thriving, network data traffic continues to surge, resulting in the rapid development of ultra-high-speed, high-capacity optical communication networks, large-scale data center, and other business types. The demand for greater bandwidth and higher transmission rates poses new challenges and requirements for optical fibre transmission network technology.

G.654.E Fibre for Long-distance Transmission

To address signal degradation arising from the OSNR limitations of systems at 400G and above, YOFC's G.654.E fibre boasts lower fibre attenuation, which reduces amplification gain (thus minimizing ASE noise), and a larger effective area, which decreases optical power density ($mW/\mu m^2$), thereby mitigating nonlinear noise. In this way, the distance of repeaterless transmission can be increased, resulting in ultra-long-distance transmission.

Hollow-core Anti-resonant Fibre (HC-ARF)

HC-ARF features a simple structure, hollow-core light guide, and a wide transmission spectrum. This kind of fibre is mainly used in light-filler interaction, nonlinear optics, gas detection, gas laser generation, and optofluidics. Due to its characteristics such as ultra-low loss, low dispersion, low nonlinearity, and a transmission rate close to that of light, the hollow-core fibre can enable the development of hollow-core fibre transmission and communication devices. This lays a foundation for the development of next-generation optical communication systems with ultra-large capacity, low latency and high speed.

Erbium Doped Fibre (EDF)

EDF is the most important structure of the erbium doped fibre amplifier (EDFA) and its performance directly determines the amplification capability of the whole EDFA system. YOFC's EDF adopts an erbium-aluminum co-doping design to ensure superior performance, meet stringent amplifier design requirements, achieve optical amplification in the C band, maintain flat gain within the amplification bandwidth, and achieve high power conversion efficiency. This kind of fibre can be applied in DWDM amplifiers, CATV amplifiers, 980nm or 1,480nm pumps, as well as land or underwater communications.

Polarization-maintaining Fibre for Component

The polarization-maintaining fibre for component is primarily used in optical communication scenarios sensitive to optical polarization states, such as collimators, polarization-maintaining jumpers, and polarization-maintaining isolators. Specifically, small-mode-field and fine-diameter polarization-maintaining fibres for component are suitable for coupling with silicon optical chips and small-sized transceivers.

In recent years, polarization-maintaining fibres for communication devices have changed with the miniaturization of the devices. They are required to maintain robust optical and mechanical performance when being used at a bending radius of 5mm for a long time. To this end, YOFC has developed the R5 anti-bending series of polarization-maintaining fibre for component. This series not only meets key indicator requirements such as macro-bending loss, macro-bending crosstalk, and full temperature crosstalk, but also emphasizes client-side application performance, including polishing and splicing performance. Currently, YOFC's R5 anti-bending series of polarization-maintaining fibre for component has been fully put on the market and passed both internal and client-side reliability verification. This series has been widely used in 400G ZR4+ transceivers, coherent transceivers, CPO transceivers, and 800G silicon photonics transceivers, winning unanimous praise from the market. Meanwhile, YOFC has launched the small-mode-field polarization-maintaining fibre for component to solve the problems of excessive splicing loss in small-mode-field and conventional-mode-field fibres. It meets the insertion loss and uniformity requirements of related FA devices.

OM5 Multi-mode Fibre for Data Center

YOFC's OM5 bend insensitive multimode fibre is designed for short wavelength division multiplexing (SWDM). This kind of fibre features high bandwidth within the 850-950nm wavelength range and is compatible with the existing OM4 fibre. The OM5 fibre is scalable and flexible. It can support higher-speed network transmission through fewer multi-mode fibre cores resulting from increases in the baud rate (PAM4) and the number of wavelengths. Its overall cost and power consumption are significantly lower than those of the single-mode fibre. Thus, it can be widely applied in super-large data centers with a capacity of 200G, 400G, 1T, or beyond.

Multi-core Fibre, Few-mode Fibre, and Transceiver

The multi-core fibre, based on the concept of space division multiplexing (SDM), enables the simultaneous transmission of multiple optical signals within a single fibre. This kind of fibre can significantly increase communication capacity to surpass the current transmission capacity limits of conventional single-mode fibres. Using the limited, stable modes in the few-mode fibre as independent channels for mode multiplexing can greatly improve system capacity and solve the future bandwidth crisis of the single-mode fibre. The multi-core fibre fan-in/fan-out device is used for the high-efficiency coupling of various multi-core fibre cores and several single-mode fibres. It enables channel space division multiplexing and demultiplexing functions in various multi-core fibre applications.

Heat-resistant and Radiation-resistant Technologies

As optical fibres are applied in increasingly diverse scenarios and more hostile environments, such as environments with strong radiation, high pressure, high temperatures, and complex gas chemical environments, Yang Chen detailed the development of technologies related to irradiation-resistant and heat-resistant optical fibres required in these harsh environments.

In recent years, with advancements in specialty product technologies, YOFC has increasingly diversified its specialty optical fibre products. This has further consolidated the company's leading position in the field of specialty products and enhanced overall business diversity. In the future, YOFC will stay committed to the development of the specialty optical fibre industry, focus on key core technology areas and pursue technological-innovation-driven development to enhance its core competitiveness. It will develop more high-performance products and strive to provide global customers with high-quality, reliable specialty product solutions tailored for optical communication and data center applications.