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今日长飞



**P16 长飞潜江科技园成功投产
打造全球最大光纤预制棒生产研发基地**
YOFC Qianjiang High-tech Industrial Park Commences Production
Build the World's Largest Optical Fibre and Preform Production and R&D Base

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Contents 目录

02 刊首语 Foreword

潜龙腾跃，智造长飞

Swift Rise in Qianjiang, Intelligent Manufacturing in YOFC

04 新闻 / 要闻 News

长飞公司举行2016年业绩发布会——集团收入再创新高，派息大幅增长

YOFC Held the 2016 Annual Performance Press Conference

——Group Revenue Hitting a New High and Distributed Dividend Growing Substantially



07 浙江联飞光纤光缆有限公司成功投产

——打造中国华东地区最有影响力的光纤供应商

Zhejiang Ally First Optical Fibre and Cable Co.,Ltd. Successfully Put into Operation

——Creating the Most Influenced Optical Fibre Supplier in East China

09 新闻 / 简讯 News

全国人大常委会副委员长沈跃跃一行来长飞公司执法检查

Vice Chairman of the Standing Committee of the National People's Congress Shen Yueyue Conducts Law Enforcement Survey on YOFC

10 长飞公司与印尼运营商签署重要项目合同

Important Contract Signed between YOFC and Indonesian Operator

11 长飞公司受邀参加第十四届中国信息港论坛

YOFC Is Invited to Attend the 14th China Information Harbor Forum

12 铁岭市政协副主席率团调研长飞沈阳公司

Vice Chairman of the CPPCC of Tieling City Visits YOFC (Shenyang)

13

长飞兰州公司、长飞中利公司开展“大学习大交流”主题活动

YOFC (Lanzhou) and YOFC (Jiangsu) Carry Out "Extensive Learning and Communication" Activity

14

新闻 / 展会 News

长飞公司闪耀慕尼黑上海光博会

YOFC Glitters at LASER World of PHOTONICS CHINA

15

长飞公司携全系列特种光纤首次亮相日本光通信技术展

YOFC makes a debut of full series optical fibre products at 2017 fibre Optics Expo in Japan



P16 专题 Special

长飞潜江科技园成功投产 打造全球最大光纤预制棒生产 研发基地

YOFC Qianjiang High-tech Industrial Park Commences Production Build the World's Largest Optical Fibre and Preform Production and R&D Base

长飞潜江科技园建成后将成为全球规模最大、竞争力最强的光纤预制棒生产与研发基地，年产值预计超过 50 亿元。

After completion of construction, YOFC Qianjiang High-tech Industrial Park will become the largest and most competitive optical fibre preform production and R&D base in the world. Its annual output value is expected to surpass 5 billion yuan.

21

嘉宾观点
Guest view

25

光纤光缆供不用求 掌握光棒核心技术方是王道
Optical Fibre and Cable Is in Short Supply and Grasping Core Technology Is the Key

27

技术 Technology

多芯光纤制备技术与应用的新进展
New Progress Made in Multi-Core Optical fibre eFabrication Technique and Application

36

下一代数据中心建设：SWDM技术与宽带多模光纤
Construction of the Next Generation of Data Centers: SWDM Technique and Wide Band Multimode fibre

46

管理 Administration

严格管控抓培训，多管齐下增效益
Strict Control of Quality and More Training to Employees for Gaining More Benefits

50

员工风采 Employee

绿色和谐，你我同行
Let Us Work Together for Green Harmony

52

随笔 Essays

参加武汉市第十三次党代会有感
My Feeling after Attending the 13th Party Congress of Wuhan City

57

病魔无情，人间有爱——感恩长飞
For the Love and Support in Combating the Ruthless——Thank You, YOFC

58

潜江情
My Attachment for Qianjiang

61

长飞，我的青春好朋友
YOFC, A Good Friend of Our Youth

潜龙腾跃，智造长飞

□ 本刊编辑部

春回大地，宾客盈门。

2017年3月21日，八方来客共聚美丽的曹禺故里，共同庆祝长飞潜江科技园竣工投产。

六十年前，中国石油人在湖北潜江发掘了全国十大油田之一的江汉油田；两年前，长飞人在潜江市委市政府的大力支持下，来到潜江建设长飞潜江科技园。往事犹在眼前，2015年6月23日，长飞公司与潜江市人民政府签署投资合作框架协议，正式拉开建设长飞潜江科技园的序幕。经过一年如火如荼的工厂建设、设备安装和调试生产，长飞潜江科技园一期项目于2017年3月21日正式投产。

长飞潜江科技园是由长飞公司主体投资建设，并由日本信越化学株式会社联合投资，法国液空集团参与的全球光通信领域的高新产业园，是长飞公司

在全球范围内整合产业链优势资源，引进领先技术，会同产业巨头，打造的技术、规模、供给保障、绿色生产多方领先的光纤光缆产业园区。

按照潜江市委市政府发展循环经济、实现智能化和绿色制造的总体思路，长飞潜江科技园以“发展循环经济”为理念，引入先进的光纤预制棒及光纤制造工艺，以实际行动引领光纤预制棒及光纤产业的绿色制造和智能制造。

长飞潜江科技园的投产，是长飞公司发展史上的又一里程碑，也将对全球光纤光缆产业格局产生重要影响。未来，长飞潜江科技园将继续专注于光纤预制棒及光纤的绿色制造、智能制造和光纤技术的广泛应用，引领国内预制棒及光纤产业的进一步发展，有力支撑国家宽带战略的实施，“纤”引世界，创造未来。

Swift Rise in Qianjiang, Intelligent Manufacturing in YOFC

□ The Editorial

When the spring comes back to the earth, the venue is full of visitors.

March 21, 2017 witnessed the gathering of visitors from all parts of the world at the native land of Cao Yu for jointly celebrating the completion and operation of YOFC Qianjiang High-tech Industrial Park.

Sixty years ago, the staff of Petro China explored Jiangnan Oilfield, one of Chinese top ten oilfields, in Qianjiang, Hubei; two years ago, under the great support of Qianjiang municipal Party committee and government, the staff of YOFC came to Qianjiang for constructing YOFC Qianjiang Science & Technology Park. We still remember that YOFC and Qianjiang municipal government signed an investment cooperation framework agreement on June 23, 2015, formally kicking off the construction of YOFC Qianjiang High-tech Industrial Park. Through one-year vigorous plant construction, equipment installation, commissioning and test run, Phase I project of YOFC Qianjiang High-tech Industrial Park

YOFC Qianjiang High-tech Industrial Park was a new and hi-tech industrial park of global optical communication field, which was invested and constructed by YOFC as a key player, co-invested by Japanese Shin-Etsu Chemical Co., Ltd., participated in by French Air Liquide Group. It is also an optical fibre cable industrial park which is leading in technology, scale, supply

guarantee and green production etc., created by YOFC through its efforts in integrating superior resources of the industrial chain across the globe, introducing leading technologies and joining hands with industrial giants.

In the light of the general ideas of Qianjiang municipal Party committee and government on developing cyclic economy and achieving intelligent and green manufacturing, YOFC Qianjiang High-tech Industrial Park, basing on the concept of "developing cyclic economy", introduced advanced optical fibre preform and optical fibre manufacturing process and took the lead in green manufacturing and intelligent manufacturing of optical fibre preform and optical fibre industry with concrete actions.

The operation of YOFC Qianjiang High-tech Industrial Park is another milestone in the development history of YOFC and will also have an important effect upon the global optical fibre cable industrial pattern. In the future, YOFC Qianjiang High-tech Industrial Park will continue to devote itself to green manufacturing and intelligent manufacturing of optical fibre preform and optical fibre and extensive use of optical fibre technology, usher in further development of optical fibre preform and optical fibre industry at home, provide a vigorous support to the implementation of the national broadband strategy, take the lead through "fibre" and create a bright future.

长飞公司举行2016年业绩发布会

——集团收入再创新高，派息大幅增长

□本刊编辑部



长飞公司于3月27日在中国香港成功举行了2016年度业绩发布会，向投资者公布了公司及其附属公司截至2016年12月31日的成绩单。会上，长飞公司执行董事兼总裁庄丹、副总裁Jan Bongaerts、财务总监梁冠宁分别就公司发展战略和未来前景、行业概况及市场预测、公司财务经营状况等内容作了全面而详细的介绍，对投资者在现场提出的问题进行了深入浅出的解答，会场气氛热烈。

作为全球最大的光纤预制棒、光纤和光缆供应商，2016年长飞公司在持续巩固光纤预制棒、光纤和光缆业务优势，保持国内市场领先地位的同时，深化实施国际化战略，不断拓展海外市场，继续向产业链上下游延伸，积极拓展多元化业务，大力推广新产品，扩大客户范围和市场空间，使得长飞公司收入再创新高。

营收与利润大幅增长

2016年终期业绩公告数据显示，截至2016年12月31日，长飞公司总营收达81亿元，同比增长20.4%，总毛利达16.75亿元，毛利率达20.7%，归属股东净利润为7亿元，同比增长22.9%。公司董事会建议派发末期股利每股0.255元。

得益于三大电信运营商2016年大力推进4G网络基础设施建设，以及国家持续落实“宽带中国”、“互联网+”等国家战略，光纤和光缆的需求大幅提高。公司的光纤及光纤预制棒

营收40.7亿元，同比增长8.4%，占总营收50.3%，光缆营收35.8亿元，同比增长35.5%，占总营收44.2%。

2016年长飞公司在国内外电信运营商市场业务的长足发展，也是推动收入增长的主要动力源之一。按地区划分，总额73.9亿元的收入来自中国客户，较2015年增长19.3%；总额7.03亿元的收入来自海外客户，较2015年增长32.7%，主要驱动因素是光缆及电缆销售增长。

“全球第一，行业领袖”

2016年长飞公司在取得可观的财务业绩外，同样获得了显著的成就和业界认可。其中长飞公司“自主预制棒及光纤产业化智能制造项目”获批工信部、财政部智能制造综合标准化与新模式应用项目。“长飞智造”赢得社会广泛关注和认可，连续被《新闻联播》、《经济半小时》、《人民日报》等报道，公司正在践行和引领从“汉阳造”到“光谷梦”。同时，长飞公司作为行业唯一代表相继中标工信部2016年制造业单项冠军（第一批）“单项冠军示范企业”和“工业强基工程”项目，彰显了长飞的综合实力和行业地位。2016年，长飞公司还成功举办了全球行业三大盛会之一——CRU全球光纤光缆大会，并连续3年获得ICQCC国际质量管理金奖，以及获得“中国质量奖”提名奖、“质量领导力国际之星”等多项国内外质量大奖，使得长飞公司品牌影响力进一步提升。

面对集团收入再创新高的大好形势，庄丹在发布会上表示：未来，长飞公司将紧密围绕“全球第一，行业领袖”的发展战略，推动光棒、纤、缆业务内涵增长；深化实施国际化；优化技术创新与智能制造，搭建集团研发平台，创新产品研发体系，推出更多有市场潜力和竞争优势的产品和解决方案；积极探索多元化发展，并在特种产品、服务、材料与应用等方向上寻求新的进入机会；提升资本运营，从而促使公司快速发展，促进集团收入和利润持续增长，为股东和客户创造更高价值。



YOFC Held the 2016 Annual Performance Press Conference

—Group Revenue Hitting a New High and Distributed Dividend Growing Substantially

□ The Editorial

On March 27, the YOFC held the annual performance conference of 2016 in Hong Kong, China, and announced the performance report of the company and its subsidiaries as at December 31, 2016. At the meeting, Zhuang Dan, executive director and president of the YOFC, vice president Jan Bongaerts and chief financial officer (CFO) Liang Guanning respectively delivered their comprehensive and detailed introductions on the company's strategy for development and future prospects, industry profiles and market forecasts, the company's financial management and other content. They also answered questions raised by investors presented at the meeting professionally while using simple language. The atmosphere of the meeting was rather warm and animated.

As the world's largest supplier for fibre preform, optical fibre and cable, in 2016, the YOFC continues to consolidate

its supremacy in optical fibre preform, fiber and cable businesses and to maintain its leading position in domestic market. At the same time, the company strives to deepen the implementation of the strategy of globalization and to expand overseas markets constantly. The YOFC continued to extend towards the upstream and downstream of the industrial chain, actively developed diversified services, vigorously promoted the new products as well as expanded the range of customers and market space, thus making the revenue of YOFC hit a new record high.

Revenue and profits increased significantly

According to the data in the year-end performance announcement of 2016, by December 31, 2016, the YOFC's total revenue is 8.1 billion yuan, with a year-on-year growth of 20.4%. The gross profit is 1.675 billion yuan with the gross margin of

20.7%. The net profit attributable to shareholders is 700 million yuan, with a year-on-year increase of 22.9%. Board of directors of YOFC suggests distributing the final dividend at 0.255 yuan per share.

In 2016, the demand for optical fibre and cable has been greatly increased thanks to the vigorous promotion of 4G network infrastructure construction by China's three telecommunications operators as well as the continuous implementation of such national strategies as "Broadband China" and "Internet +". The revenue of optical fibre and optical fibre preform segment reaches to 4.07 billion yuan, with a year-on-year increase of 8.4%, accounting for 50.3% of total revenue. The revenue of optical cable segment is 3.58 billion yuan, with a year-on-year increase of 35.5%, constituting 44.2% of total revenue.

The substantial development of the YOFC's business in the domestic and international markets of telecom operators is also one of the main driving forces to promote the company's revenue growth. With accordance to situations of different regions, the revenue of 7.39 billion yuan is from Chinese customers, an increase of 19.3% over 2015; the revenue of 703 million yuan is from overseas customers, an increase of 32.7% over 2015. and the primary driving factor is the sales growth of optical cable and cable.

"Being No.1 in the world and the leader of the industry"

In 2016, the YOFC has not only had a remarkable financial performance, but also gained significant achievements and recognition of the industry. The "Independent Preform and Optical Fibre Industrialization Intelligent



Manufacturing Project" of YOFC has been approved by the Ministry of Industry and Information Technology of China and Ministry of Finance as the intelligent manufacturing integrated standardization and new model application project. "Made by the YOFC" has won wide attention and recognition of the industry, and has been continuously reported by TV programme such as "CCTV NEWS", "Half-hour Economy", "People's Daily". The YOFC is practicing and leading its way from "Made by Hanyang" to "Optical Valley Dream". Meanwhile, as the only representative in the industry, YOFC has successively won the bidding of the Ministry of Industry and Information Technology such as "Single Champion Demonstration Enterprise" of the single champion of the manufacturing industry (the first batch) as well as the project of "Industrial Strong Base Engineering", which has manifested the comprehensive strength and position in industry of YOFC. At the end of 2016, YOFC successfully held CRU Global Optical Fibre and Cable Conference, one of the three grand conferences in the industry, and has won the ICQCC International Quality Management Gold Award in three consecutive years. It has also won many quality awards both at home and abroad including the nomination of China's Quality Award and the International Star of Quality Leadership, further enhancing the influence of the YOFC.

Having achieved the excellent performance of the company with its revenue reaching to a new high, Zhuang Dan expressed at the meeting that in the future, the YOFC will intensely focus on the development strategy of "being No.1 in the world and the leader of the industry", adhere to connotative promotion in the business of optical preform, fibre and cable. The YOFC will deepen the implementation of globalization of the company, optimize technological innovation and intelligent manufacturing, build the platform of research and development, and innovative the system of research and development for its products and introduce more products and solutions with more market potential and competitive advantages. The YOFC will strive to pursue the diversification of its development, and seek new access to businesses of specialty products, service, materials and applications. The YOFC will to enhance its capital operation, so as to promote the rapid development of the company, to increase the company's revenue and profits to grow continuously, and to create more value for the company's shareholders and customers.





浙江联飞光纤光缆有限公司成功投产 ——打造中国华东地区最有影响力的光纤供应商

□ 联飞公司 汪方伟

3月18日，浙江联飞光纤光缆有限公司（以下简称联飞公司）投产典礼在浙江省临安市青山湖科技城隆重举行。浙江省临安市委副书记、市长骆安全，市委常委、青山湖科技城党工委书记、管委会主任沈慧，临安市副市长王翔等领导莅临奠基现场表示祝贺。长飞公司董事长马杰、副总裁周理晶、销售总监郑昕、市场及战略总监江志康，联飞公司副董事长韩雪光、总经理孙志宇参加了投产典礼。

联飞公司由长飞公司与临安电线电缆协会主要成员企业共同出资组建，总投资5亿元，于2016年3月奠基并开工动建，经过一年如火如荼的工厂建设、设备安装和调试生产，联飞公司实现正式投产。

沈慧在投产典礼上发表讲话，她指出，联飞公司不仅是长飞公司融入华东市场的重要布局，也是临安线缆产业主动转型升级的重要一步，对临安市推进产业现代化具有良好的示范带动作用，标志着临安市与长飞公司的合作正式开花结果。

长飞公司董事长马杰在致辞中强调，联飞公司是长飞公司落实“全球第一，行业领袖”战略目标，打造“四大中心”，完善全球布局，夯实光纤光缆市场领先优势的重要举措。联飞公司如期投产无疑是顺应潮流之举，投产后的联飞公司将能够满足临安电线电缆企业转型升级过程中的光纤需求，为临安电线电缆企业在技术升级浪潮中谋求产业企业良性发展奠定坚实基础。

近年来，随着“光进铜退”的深入，光纤取代同轴电缆进入广电传输领域已是历史必然，以广电客户为主的临安电线电缆企业迫切需要向光纤光缆领域转型升级。长飞公司一直致力于光纤技术的广泛应用，经过29年的发展，已经成为全球最大的光纤预制棒、光纤和光缆供应商，其强大的技术和品牌优势，将为临安电线电缆企业向光纤光缆领域转型升级提供有力的支持。未来，联飞公司将打造成中国华东地区最有影响力的光纤供应商。

Zhejiang Ally First Optical Fibre and Cable Co.,Ltd. Successfully Put into Operation

—Creating the Most Influenced Optical Fibre Supplier in East China

□ Wang Fangwei from AFOC



On March 18, the inauguration ceremony for production of Zhejiang Ally First Optical Fibre and Cable Co.,Ltd. (AFOC) is held in Qingshanhu High-tech Industrial park in the city of Lin'an, Zhejiang Province. Luo Anquan, Deputy Municipal Party Secretary and Mayor of Lin'an, Shen Hui, member of the Standing Committee of Municipal Party Committee, Party Committee Secretary of the park and director of the CMC, and Wang Xiang, vice mayor of Lin'an and other leaders are present at ceremony to congratulate the inauguration. Ma Jie, Chairman of YOFC, Zhou Lijing, the Vice President, Zheng Xin, the sales director, Jiang Zhikang, the marketing and strategy director, Han Xueguang, vice president of the Ally First Optical Fibre, Sun Zhiyu, general manager of the AFOF have also attended the ceremony.

The Ally First Optical Fibre Company was built jointly by the YOFC and major member enterprises of the Association of Cable and Cords of Lin'an. The AFOC has a total investment of 500 million yuan, Its construction was initiated in March 2016, and after a year full-swing factory building, equipment installation and production adjustment, the AFOC has been successfully put into operation.

Shen Hui delivered a speech at the ceremony. She pointed out that the Ally First Optical Fibre Company is not only the important layout of the YOFC into the market in East China, but also an important step in the initiative upgrade of Lin'an's cable industry. It will be a good model enterprise for the industrial modernization of Lin'an, and it also marks the fruits of the cooperation of Lin'an and the YOFC.

Ma Jie, Chairman of the company, stressed that the company is an important step to implement the strategy of "being No.1 in the world and the leader of the industry" and also a crucial approach to build "the four centers", improve the global layout,

consolidate the leading position in the market of optical fibre and cable. The scheduled production of the AFOC is no doubt the measure to ride the tide of the time. After the operation and production, the company will be able to meet the demand of Lin'an cable and core enterprises in its transformation and upgrade, and lay solid foundation for the development of its cable and core enterprises in the wave of technology upgrade.

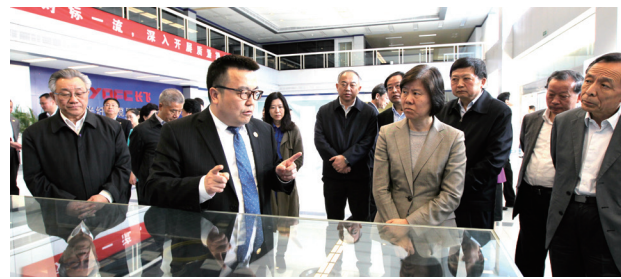
In recent years, with more optical cable in and copper cable out, we can see that it is inevitable that optical fibre will finally replace the coaxial cable into the field of radio and television transmission. The cable and core enterprises of Lin'an, whose customers are mainly in the field of radio and television transmission, are in urgent need to transform and upgrade into the optical cable field. The YOFC has been committed to the extensive application of optical fibre technology. After the development of 29 years, the YOFC has become the world's largest supplier of fibre preform, fibre and cable. It boasts advanced technology and brand supremacy, so it will provide cable and core enterprises of Lin'an with powerful support in its transformation and upgrade. In the future, the AFOC will grow into the most influential supplier in east China.

全国人大常委会副委员长沈跃跃一行 来长飞公司执法检查

□ 本刊编辑部

4月11~15日，全国人大常委会副委员长沈跃跃率全国人大常委会产品质量法执法检查组来湖北进行执法检查，并于4月13日在省市领导的陪同下莅临长飞公司检查。长飞公司执行董事兼总裁庄丹、荣誉副总裁张穆等出席接待。

庄总对沈委员长一行的到来表示热烈欢迎，并向来访领导介绍了长飞公司发展情况和质量管理现状。庄总表示，作为行业领导者，长飞公司带头提倡行业产品质量自律，倡导和签署了我国光纤光缆行业第一个《光纤光缆产品质量自律公约》，促进中国光纤光缆行业可持续发展。同时，长飞公司也是中国通信行业第一家通过ISO9002质量体系认证的企业，近年来先后获得国际质量管理金奖、欧洲质量白金奖、中国质量奖提名奖、湖北省长江质量奖、武汉市市长质量奖等国内外质量大奖，获得社会广泛认可。



沈委员长对长飞公司贯彻实施《中华人民共和国产品质量法》、创新管理、智能制造等方面的工作给予了充分肯定，并希望企业从“质量强国、质量兴企、质量惠民”的高度，充分认识产品质量工作的重要意义，牢固树立“质量第一”的强烈意识，依法推动产品质量提升工作。

Vice Chairman of the Standing Committee of the National People's Congress Shen Yueyue Conducts Law Enforcement Survey on YOFC

□ The Editorial

From 11 April to 15 April, the product quality law enforcement inspection team of the Standing Committee of the National People's Congress, led by Vice Chairman of the Standing Committee of the National People's Congress Shen Yueyue, arrived in Hubei Province and conducted a survey on law enforcement. On 13 April, accompanied by leaders at provincial and municipal level, Chairman Shen and his company arrived at YOFC and conducted a survey. Executive Director and President of YOFC Dan Zhuang and Honorary Vice President Zhang Mu received them.

Mr. Zhuang extended his warm welcome to their visit, and then introduced the development and status of quality management of YOFC. Mr. Zhuang said, as an industry leader, YOFC took initiative to advocate product quality self-discipline, initiated and signed the first Optical Fibre and Cable Product Quality Self-Discipline Convention, to promote the sustainable development of Chinese optical fibre and cable industry. In

addition, YOFC is the first enterprise in the Chinese communication industry that has passed ISO9002 Quality System Certification. In recent years, it has obtained International Quality Management Golden Award, Arch of Europe Quality Award, China Quality Award Nomination, Hubei Province Changjiang River Quality Award, Wuhan City Mayor Quality Award and other domestic and overseas quality awards. YOFC has been widely recognized by the society.

Chairman Shen fully recognized YOFC's work in implementing Product Quality Law of the People's Republic of China, innovation management and intelligent manufacturing, and hopes that the enterprise can uphold the slogan of "Turning China into a quality powerhouse, making the enterprise thrive and benefiting people with better quality products", fully understand the great significance of product quality work, firmly establish the awareness of "Quality First", and improve product quality in accordance with law.

长飞公司与印尼运营商 签署重要项目合同

□ 国际业务与咨询服务中心 孔文韬



近日，长飞公司印尼办事处代表公司与印尼某运营商签署了覆盖印尼全国的光缆干线项目合同，销售光缆超过5000公里，合同金额超过4000万元人民币。这批光缆将全部从武汉运送至印尼，第一批光缆已到货1500公里，后续将在4个月左右的时间完成全部供货。

作为东盟最大的经济体，印尼近年来大力发展信息化建设，光纤光缆需求不断增长。目前，长飞公司在印尼已先后成立两家合资公司，长飞印尼光纤公司已顺利投产并在当年实现盈利，长飞印尼光缆工厂正在紧锣密鼓地建设之中。未来，长飞公司将会成为印尼首具备光纤光缆完整本地生产能力的供应商，为当地通信事业做出重大贡献。

Important Contract Signed between YOFC and Indonesian Operator

□ Kong Wentao from International Business and Consulting Service Center

Recently, YOFC's Indonesian office on behalf of YOFC and an Indonesian operator signed a contract for the sale of over 5,000km optical cables at the contract amount of more than RMB 40 million Yuan, for an optical trunk cable project that covers the whole country of Indonesia. These cables will be shipped from Wuhan to Indonesia. The first batch of 1,500km cables has already been delivered, and the rest will be delivered in about 4 months.

As the largest economy in ASEAN, Indonesia has put great efforts to develop information technology in recent years, thus seeing continuous growth in the demand for optical cables. YOFC has already set up two joint ventures in Indonesia, including an optical fibre company, which has been put into operation successfully and has proven profitable in the first year of operation, and an optical fibre cable manufacturing plant, which is under construction. In the future,



YOFC will become Indonesia's first local supplier that is able to produce complete products of optical fibres and cables, making significant contributions to local communications industry.

长飞公司受邀参加第十四届中国信息港论坛

□ 本刊编辑部



4月13日，由工业和信息化部、江西省人民政府指导，人民邮电报社、江西省通信管理局、鹰潭市人民政府承办的第十四届中国信息港论坛在江西鹰潭隆重举行，论坛围绕“携手

推进网络强国”的主题，深入研讨了网络强国战略目标下信息通信业面临的使命、责任，以及行业发展的新进展、新机遇、新挑战和新思路。

长飞公司战略与市场部经理周钦敏受邀参加此次会议，长飞公司资深专家张方海在此次论坛的专题峰会“网络设施建设”中做了主题为“新型光纤助力下一代网络建设”的演讲，回顾了长飞公司为中国光纤光缆产业和中国通信事业的发展作出的突出贡献，介绍了长飞公司在超低衰减G.654光纤、宽带OM5多模光纤、多芯光纤、少模光纤等新型光纤领域最新研发进展和应用成果。中国电信、中国移动、中国联通等运营商的相关领导在峰会上分别发表了主题演讲，并充分肯定了长飞公司超低衰减G.654.E光纤对推动民族光纤产业发展的特殊贡献和重要意义。

YOFC Is Invited to Attend the 14th China Information Harbor Forum

□ The Editorial

On April 13, guided by Ministry of Industry and Information Technology, Jiangxi Provincial People's Government, the 14th China Information Harbor Forum undertaken by Posts & Telecom Newspaper Office, Jiangxi Communication Administration and Yingtang Municipal People's Government was grandly held in Yingtang, Jiangxi. The theme, centering around the theme of "joining hands to pushing for making the country prosperous through cyber", carried out an in-depth discussion on the missions and responsibilities for information technology and telecom sector under the strategic objective of making the country prosperous through cyber as well as new progress, new opportunity, new challenge and new thinking.

Zhou Qinmin, manager of YOFC's Strategy and Market Department, was invited to attend the event. Zhang Fanghai, senior expert of YOFC delivered a speech themed

"new type optical fibre gives a hand to the building of the next generation network" at the special summit of the forum "network facility construction", reviewing the outstanding contribution of YOFC to the development of Chinese optical fibre and optical cable industry and telecom undertaking, introducing YOFC's latest R&D progress and application achievement in ultra-low attenuation G.654 optical fibre, broadband OM5 multi-mode optical fibre, multi-core optical fibre, few-mode optical fibre and new type optical fibre fields. The relevant executives of China Telecom, China Mobile, China Unicom and other operators delivered keynote speeches at the summit respectively, fully affirming the special contribution and important significance of YOFC's ultra-low attenuation G.654.E optical fibre in pushing forward the development of national optical fibre industry.

铁岭市政协副主席 率团调研长飞沈阳公司

□ 长飞沈阳公司 宫廷立

3月31日，铁岭市政协副主席李宇娟率调研团莅临长飞沈阳公司进行企业调研活动，长飞沈阳公司技术总监杨笛雨、生产部经理向往以及相关部门主管接待了政协调研团队。调研团队参观了长飞沈阳公司的生产车间，公司相关部门负责人对车间的各工序进行了讲解。在参观过程中，调研团队了解了车间生产环境以及光缆的生产工艺，杨总监向调研团队介绍了长飞沈阳公司的未来发展方向，得到了政协领导们的一致认可和赞许。

自成立以来，长飞沈阳公司得到了当地政府的大力支持，建成投产的第一年就实现了盈利。借助长飞公司的行业领袖地位、稳定的客户关系以及丰富的管理经验，长飞沈阳公司充分利用铁岭地区的战略优势和优惠政策，提高市场的快速响应能力，降低运输成本，缩短交货期，做到高效供货，使得长飞公司在北



方市场上赢得主动权，缩短与邻国的订单交货期，更好更快地服务于客户。



Vice Chairman of the CPPCC of Tieling City Visits YOFC (Shenyang)

□ Gong Tingli from YOFC (Shenyang)

On 31 March, vice chairman of the CPPCC of Tieling City Li Yujuan led a survey team to visit YOFC (Shenyang) and conduct a survey on the enterprise. Technical director of YOFC (Shenyang) Yang Diyu and manager of the production department Xiang Wang and heads of relevant departments received them. The survey team visited production workshops of YOFC (Shenyang). Heads of relevant departments of the company explained every process in the workshops. During the visit, the survey team learned the production environment of workshops and the production process of optical cables. Director Yang introduced the future development plan of YOFC (Shenyang), which won unanimous acknowledgement and appraisal from leaders from the CPPCC.

Since its incorporation, YOFC (Shenyang) has obtained great support from local government. It made a profit in the first year after its completion of construction and commencement of operation. Leveraging on YOFC's leading position in the industry, stable customer relationship and abundant management experience, YOFC (Shenyang) fully made use of strategy advantages and preferential policies of Tieling area, improved ability of rapidly responding to the market, reduced transportation cost, and shortened the delivery term. As a result, YOFC realized supply of goods in an effective way, gained competitiveness in the Northern China market, shortened the delivery term with neighboring countries, to provide better and more efficient services to customers.

长飞兰州公司、长飞中利公司 开展“大学习大交流”主题活动

□ 长飞兰州公司 牛涛

3月20日，为了促进公司团队建设，有效提升团队的执行力和协作性，长飞兰州公司总经理刘爱华带领人力资源行政部、财务部、供应链部、生产技术部以及设备维修组的5名相关管理人员抵达江苏常熟，与长飞中利公司开展“大学习大交流”的学习交流活动。长飞中利公司总经理蒋湏、行政总监龚雄和生产总监蔡杰对长飞兰州公司学习交流团队的到来表示热烈欢迎，并向大家介绍了长飞中利公司的基本情况。长飞中利公司由长飞光纤光缆有限公司和中利科技集团公司共同投资建设，在运营管理、生产管理和设备维护方面积累了丰富的经

验。

双方从人员管理、原材料控制、生产工艺和设备维修保养等重点话题出发，就“保证质量、增强管理、提高效率、降低成本”等相关问题进行了深入的探讨和交流。

刘总对长飞中利公司表示诚挚感谢，并指出，转变工作态度和提高创新意识是长飞兰州公司的当务之急。各负责人应带头从自身实际出发，勤于学习、主动思考，贴合团队的共同目标，发扬“创新精神、拼搏精神和主人翁精神”，建立勇于创新、敢于拼搏的优秀团队，促进公司不断进步和发展。

YOFC (Lanzhou) and YOFC (jiangsu) Carry Out "Extensive Learning and Communication" Activity

□ Niu Tao from YOFC(Lanzhou)

On 20 March, in order to promote team building of the company, effectively improve executive power and coordination of teams, General Manager of YOFC (Lanzhou) Liu Aihua and five management officers from the Human Resources & Administration Department, the Finance Department, the Supply Chain Department, the Production Technology Department and the Equipment Maintenance Team arrived in Changshu, Jiangsu Province, and carried out an activity of learning and communication entitled "Extensive Learning and Communication" with YOFC (jiangsu) . General Manager of YOFC (jiangsu) Jiang Yun, Executive Director Gong Xiong and Production Director Caijie extended a warm welcome to the study and communication team from YOFC (Lanzhou) , and introduced the basic situation of YOFC (jiangsu) . YOFC (jiangsu) is a joint venture established by Yangtze Optical Fibre and Cable Company Limited and Zhongli Technology

Group Company. It has accumulated profound experience in operational management, production management and equipment maintenance.

Both parties deeply discussed issues relating to how to ensure quality, enhance management, increase efficiency and reduce cost, in respect of personnel management, raw materials control, production craftsmanship and equipment repair and maintenance.

Mr. Liu expressed his gratitude to YOFC (jiangsu) . He said, the top priority of YOFC (Lanzhou) is to transfer work attitude and increase innovation awareness. The heads of different departments, based on the actual situation, should study hard and think positively, set up common goals that suit for the group, convey "Innovation spirit, fighting spirit and entrepreneurial spirit", build an excellent team that dares to make innovation and fight, and promote the continuous advancement and development of the company.

长飞公司 闪耀慕尼黑上海光博会

□ 特种产品事业部 徐祖应

2017年慕尼黑上海光博会于3月14~16日在上海新国际博览中心举办，长飞公司携特种光纤精彩亮相此次光博会。

长飞公司特种产品事业部多年来一直致力于特种光纤及衍生产品的研究开发与应用，今年重点推出了光纤激光器用掺镱光纤及无源匹配光纤解决方案。经过多年的自主研发与产品改进，长飞公司的掺镱光纤已不断突破光纤的长期可靠性、低光子暗化和耐高功率水平等系列难题。同时，长飞公司的大棒技术和CDS沉积工艺促进了光纤的几何均匀性和高掺杂浓度，



这些特点使得长飞公司掺镱光纤具备国外厂商所不具备的核心优势，真正迈出了光纤激光器掺杂光纤国产化的第一步。

此次长飞公司除了重点推出光纤激光器用掺镱光纤及无源匹配光纤解决方案外，还展出了光纤放大器掺杂光纤及高功率放大模块、多芯光纤及扇入扇出耦合器、光纤陀螺全套产品解决方案等其它全系列特种光纤产品。同时，在相关多元化领域，长飞公司展出光纤光栅、SFP+芯片等光器件和AOC有源光缆长距离高清系列解决方案，吸引了国内外商家和参展观众的眼球。

YOFC Glitters at LASER World of PHOTONICS CHINA

□ Xu Zuying from Specialty Products Business Unit



2017 LASER World of PHOTONICS CHINA was held at Shanghai New International Expo Centre on March 14-16. On the event, YOFC revealed its special optical fibre.

YOFC's Special Products Division has been committing itself to the research, development and application of special optical fibres and derivative products for years. This year, it focuses on launching ytterbium-doped optical fibres for optical fibre laser and passive matching optical fibre solutions. Through years of independent R&D and product improvement, YOFC has made continuous breakthroughs in

series problems of optical fibre such as long-term reliability, low photo-darkening and resistance to high power level etc. Besides, the big bar technology and CDS deposition technology owned by YOFC have also promoted the geometric uniformity and high doping concentration. All those features have enabled YOFC's ytterbium-doped optical fibre to enjoy core advantages over overseas producers and genuinely made its first step in the localization of ytterbium-doped optical fibre for optical fibre laser.

In addition to focusing on the launch of ytterbium-doped optical fibres for optical fibre laser and passive matching optical fibre solutions at the event, YOFC has also showcased its optical fibre amplifier doped fibre and high power amplifying module, multi-core optical fibre and fan-in and fan-out coupler, fibre optic gyroscope package solutions and other full series special optical fibre products. Meanwhile, in relevant diversified fields, YOFC has also displayed its optical fibre grating, SFP+core and other optical appliances, AOC active long-distance high definition series solutions, which has attracted the eyeballs of businesses and visitors at home and abroad.

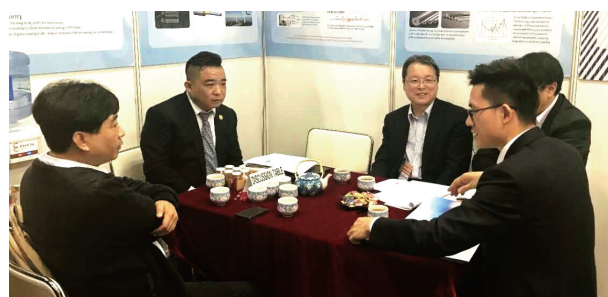
长飞公司携全系列特种光纤 首次亮相日本光通信技术展

□ 特种产品事业部 毕伟

第17届日本光通信技术展（FOE）于4月5~7日在东京有明国际展览中心举行，长飞公司携全系列特种光纤首次亮相日本光通信技术展。

作为全球领先的特种光纤供应商，此次参会，长飞公司注重的是对具体的优质特种光纤展示，这也与日本光通信技术展(FOE)一向以“精”、“专”的整体风格不谋而合。长飞重点展出了光纤激光器有源光纤、多芯光纤、光纤传感及其它系列特种光纤产品。

其中，光纤激光器用有源光纤颇具看点。经过多年的研发与改进，长飞特种产品技术团队不断突破光纤的长期可靠性、低光子暗化和耐高功率水平等系列难题。同时，通过充分利用公司的大棒工艺和CDS沉积工艺，进而保证了光纤精确的几何均匀性，长飞公司有源光纤系列产品拥有行业内独特的优势，其产品发展也加快了光纤激光器用有源光纤的国产化进程。在展会现场，大批来自全球的商家和专业观众前来长飞展台参观洽谈，现场气氛活跃。



YOFC makes a debut of full series optical fibre products at 2017 fibre Optics Expo in Japan

□ Bi Wei from Specialty Products Business Unit

The 17th fibre Optics Expo was held in Tokyo Big Sight Exhibition Centre on April 5-7. YOFC made a debut of full series optical fibre products at 2017 fibre Optics Expo (FOE) in Japan.

As a globally leading special optical fibre supplier, YOFC attended the event and focused on reveal of specific high-quality special optical fibre products, which also coincides with the overall style of "precision" and "specialty" of FOE. YOFC focused on exhibition of optical fibre laser active optical fibre, multi-core optical fibre, optical fibre sensing and other series special optical fibre products. Among the products, optical fibre laser active optical fibre was the highlight. Through years of independent R&D and product improvement, YOFC's special

product technical team has made a continuous breakthrough in series problems such as long-term reliability, low photo-darkening and resistance to high power level etc. Meanwhile, by making full use of the large bar process and CDS deposition process so as to ensure the precise geometric uniformity of optical fibre, YOFC's active optical fibre series products enjoy unique advantages in the sector. The development of the products has also stepped up the localization process of active optical fibre for optical fibre laser. At the venue of exposition, a great number of businesses and professional visitors coming from the world came to YOFC's booth for visit and discussion. The venue enjoys a lively atmosphere.



长飞潜江科技园成功投产 打造全球最大光纤预制棒生产研发基地

□ 本刊编辑部

3月21日，由长飞公司、信越化学工业株式会社、液化空气集团联合主办的长飞潜江科技园投产典礼在湖北省潜江市隆重举行，这标志着长飞打造全球最大光纤预制棒生产基地的第一阶段目标顺利实现，将为我国光通信市场新一轮发展注入新的活力。

年产值预计超过 50 亿元

长飞潜江科技园是长飞公司在湖

北省、潜江市和盐化工业园政府大力支持下，在全球范围内整合最领先的产业链资源，构建智能制造，发展循环经济和绿色制造的有力探索，建成后将成为全球规模最大、竞争力最强的光纤预制棒生产与研发基地，年产值预计超过50亿元。

长飞潜江科技园占地700亩，将分期进行3个项目的建设：长飞光纤潜江有限公司、长飞信越（湖北）光棒有限公司、液化空气（潜江）有限

公司。长飞光纤潜江有限公司是长飞公司旗下的全资子公司，专业从事光纤预制棒和光纤产品的研发和生产制造。全部建成后，长飞光纤潜江有限公司将是长飞集团内产能最大的单体工厂，也将是全球最大的预制棒和光纤制造基地。长飞信越（湖北）光棒有限公司是长飞公司和日本信越化学工业株式会社合资建设的光纤预制棒项目，该项目采用了目前全球最先进的OVD工艺，将有利于降低生产成

本，进一步提升光纤预制棒的竞争优势。液化空气（潜江）有限公司是法国液化空气集团旗下全资子公司，主要生产及供应氢气、氧气、氮气、氦气、氩气、二氧化碳等气体，产品主要供应科技园内部企业，有力支撑了长飞潜江科技园的清洁能源供应和循环经济建设。

光纤光缆产业正处于黄金发展期

长飞公司董事长马杰指出，长飞潜江科技园的建设正是长飞公司新的中长期战略发展引领下，致力于推动通信产业内涵增长的重要举措。在科技园内，长飞公司自主研发的VAD项目将实现规模化生产，自主光纤项目将实现智能化制造；长飞公司和日本信越公司强强联合，引进OVD工艺，打造世界领先的预制棒生产基地；长飞公司携手液化空气集团，会同盐化工业园内企业一起以“发展循环经济”为理念，促进科技园绿色发展，和谐制造。建设投产的长飞潜江科技园，将拥有全球领先的光纤光缆智能制造水平，成为成本最具竞争力的光纤光缆生产与研发基地。

长飞公司执行董事兼总裁庄丹表示，近年来，信息化对经济的拉动效应已成为全球共识，世界各国都将信息化建设作为国家建设的重中之重，光纤光缆作为信息传输的关键载体，产业正处于高速发展。预计未来5~10年，全球市场需求将持续保持在4亿芯公里以上，中国将持续在2亿芯公里以上。在旺盛需求的促动下，国内光纤光缆市场明显短缺、供不应求，全球市场也随之供给紧张，光纤光缆产业正处于黄金发展期。在巨大的市场机遇下，长飞潜江科技园如期投产无疑是顺应潮流之举。长飞公司将狠抓市场机遇，整合全球优势资源，立足中国，辐射全球，将科技园打造成为全球范围内最具影响力的光纤光缆生产和研发基地。

以“发展循环经济”为理念

尤为值得一提的是，长飞潜江公司以实际行动引领光纤预制棒及光纤产业的绿色制造和智能制造。

在“绿色制造”方面，长飞潜江公司以“发展循环经济”为理念，建立光纤预制棒及光纤光缆主要原材料的产业基地，循环利用盐化工业生产中的副产品和光纤预制棒生产过程中产生的副产物，实现高效、环保、



佐生博保先生代表齐藤恭彦先生向庄丹先生赠送礼物

低成本运营。

其中江汉盐化工业园是潜江市委市政府按照发展循环经济的思路设立的工业园区，长飞公司选择在江汉盐化工业园建设科技园并投资成立长飞潜江公司，正是基于循环经济的理念和节约运营成本的考虑：江汉盐化工业园是国家循环化改造示范试点园区，长飞潜江公司光纤预制棒项目生产过程中的稀盐酸、盐水等主要副产物都可以被循环利用；同时，长飞潜江公司紧邻江田盐化总厂，该厂离子膜烧碱工艺生产的氢气、氯气、烧碱可作为公司主要的生产原料，而且原料输送的安全性、便利性大大提高，这些都极大节约了长飞潜江公司的运营成本，如图所示。

“智能制造”成重要亮点

在“智能制造”方面，为践行《中国制造2025》行动纲领，实现工业强国的战略目标，长飞潜江公司通过智能制造实现产业升级，成为行业首家整体预制棒及光纤智能工厂。

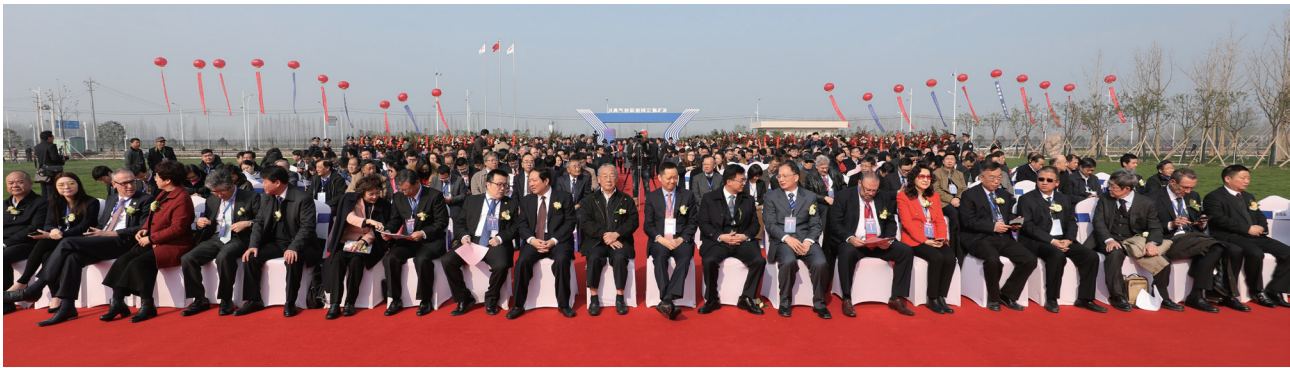
长飞潜江公司采用最新自主开发的智能化工艺设备结合智能物流、智能仓储、MES制造执行系统等技术，打造了预制棒和光纤智能制造的行业标准：基于MES、ERP、OA、SCM、APS、PLM系统的贯连，实现全业务领域运行过程动态优化，制造信息和管理信息全程透明；基于MES为核心驱动的全数字车间运行，实现生产过程的智能控制，生产管理的信息化控制；基于机器人和自动物流的应用，实现全工艺流程的自动化和柔性生产；通过大数据技术和专家系统的应用，实现工艺及生产的建模仿真和决策优化。

长飞潜江公司作为长飞潜江科技园的重要项目，积极探索预制棒和光纤生产的智能制造，让长飞自主研发的VAD/OVD制棒和光纤高速拉丝技术进入世界先进行列，促进光纤的中国制造领先世界。未来，长飞潜江公司将持续专注于光纤预制棒及光纤产业的发展和科技进步，致力于推动光纤技术的广泛应用，成为信息传输与智慧联接领域的领跑者，引领国内预制棒及光纤产业的跨越式发展，有力支撑国家宽带战略的实施。

YOFC Qianjiang High-tech Industrial Park Commences Production

Build the World's Largest Optical Fibre and Preform Production and R&D Base

□ The Editorial



On 21 March, the Launch Ceremony of the YOFC Qianjiang High-tech Industrial Park, co-organized by YOFC, Shin-Etsu Chemical Co., Ltd., and Air Liquide Group, was held in Qianjiang, Hubei Province, symbolizing that the first phase of YOFC's target of building the world's largest optical fibre preform production base has been completed. The YOFC Qianjiang High-tech Industrial Park will inject new vitality to a new round of development of Chinese optical communication market.

Annual Output Value Is Expected to Surpass 5 Billion Yuan

YOFC Qianjiang High-tech

Industrial Park is an experiment of YOFC to integrate the most advanced industrial chain resources around the world, establish intelligent manufacturing, develop recycling economy and green manufacturing, which gained great support from Hubei Provincial Government, Qianjiang Municipal Government, and Salt Chemical Industrial Park. After completion of construction, it will become the largest and most competitive optical fibre preform production and R&D base in the world. Its annual output value is expected to surpass 5 billion yuan.

The YOFC Qianjiang High-tech Industrial Park occupies an area of 700

mu. Three projects will be constructed by stages, including YOFC Optical Fibre Qianjiang Company Limited, YOFC Shin-Etsu (Hubei) Optical Fibre Company Limited, and Air Liquide (Qianjiang) Company Limited. YOFC Optical Fibre Qianjiang Company Limited, a wholly-owned subsidiary of YOFC, is specialized in R&D and production of optical fibre preforms and optical fibre products. After the completion of construction, YOFC Optical Fibre Qianjiang Company Limited will be the single factory with the largest production capacity of YOFC Group, and the biggest preform and optical fibre manufacturing base in the world. YOFC Shin-Etsu (Hubei) Optical

Fibre Company Limited is an optical fibre preform joint venture of YOFC and Shin-Etsu Chemical Co., Ltd. of Japan. The world's most advanced OVD process is adopted in this project. It will reduce production cost, and further improve the competitiveness of optical fibre preform. Air Liquide (Qianjiang) Company Limited, a wholly-owned subsidiary of Air Liquide Group of France, mainly produces and supplies hydrogen, oxygen, nitrogen, helium, argon and carbon dioxide. Its products are mainly supplied to enterprises in the High-tech Industrial Park. The company gives great support to the construction of clean energy supply and recycling economy of the YOFC Qianjiang High-tech Industrial Park.

The Optical Fibre and Cable Industry Is in a Period of Golden Development

Chairman of YOFC Ma Jie said, the construction of YOFC Qianjiang High-tech Industrial Park is an important measure of YOFC to promote intensive growth of the communication industry, under the guidance of the new mid-and-long term development strategy. In the High-tech Industrial Park, the VAD project, developed by YOFC on its own, will realize scale production. The self-developed optical fibre project will realize intelligent manufacturing. YOFC and Japan's Shin-Etsu Company worked together to build the world's advanced preform production base by introducing OVD craftsmanship. YOFC joined hands with Air Liquide Group, and enterprises in the Salt Chemical Industrial Park, to promote green development and harmonious manufacturing of the High-tech Industrial Park, adhering to the concept of "Developing recycling economy". YOFC Qianjiang High-tech Industrial Park, which has completed construction and commenced production, will have



the world's advanced optical fibre and cable intelligent manufacturing standard, and become the most cost-effective optical fibre and cable production and R&D base.

Executive Director and President of YOFC Dan Zhuang said, in recent years, it has become a common sense in the world that informationization can boost the economic development. All countries in the world give top priority to the development of informationization. As optical fibre and cable are key carriers of information transformation, the optical fibre and cable industry is developing very fast. In the next five to ten years, the demand of the global market for optical fibre and cable will remain at over 400 million KMF. The demand for optical fibre and cable in China will remain at over 200 million KMF. Due to the brisk demand, the optical fibre and cable market in China is in short supply. As a result, the global market faces tight supply too. The optical fibre and cable industry is in a period of golden development. Faced with huge market opportunities, the YOFC Qianjiang High-tech Industrial Park commenced production as scheduled, which is undoubtedly a

move conforming to the historical trend of the time. YOFC will grasp market opportunities, integrate global advantageous resources, be rooted in China and exert influence over the world. It will build the High-tech Industrial Park into the most influential optical fibre and cable production and R&D base in the world.

Adhering to the Concept of "Developing Recycling Economy"

It is worth mentioning that YOFC Qianjiang Company took concrete action to lead green manufacturing and intelligent manufacturing of the optical fibre preform and optical fibre industry.

In respect of "green manufacturing", adhering to the concept of "Developing recycling economy", YOFC Qianjiang Company established an industrial base for producing raw materials such as optical fibre preform and optical fibre and cable, circularly utilize by-products during the production of salt & chemical industry, and by-products during the production of optical fibre preforms, to realize efficient, environment-friendly and low-cost operation.



In particular, Jiangnan Salt Chemical Industrial Park is an industrial park established by the municipal party committee and the municipal government of Qianjiang City, in accordance with the concept of developing recycling economy. YOFC chose to establish a technology park in Jiangnan Salt Chemical Industrial Park and invest in and set up YOFC Qianjiang Company, which is based on the concept of recycling economy and reducing operation cost. Jiangnan Salt Chemical Industrial Park is a national recycling transformation demonstration pilot park. By-products during the production of optical fibre preforms of YOFC Qianjiang Company such as dilute hydrochloric acid and salt water can be circularly utilized. In addition, YOFC Qianjiang Company is adjacent to Jiangnan Oilfield Salt Chemical General Factory. Hydrogen, chlorine and caustic soda produced in the production process of ionic membrane caustic soda of the factory can be used as the main production materials of the company. Raw material transportation thus became safer and more convenient. All this will greatly reduce the operation cost of YOFC Qianjiang Company (As shown in figure).

"Intelligent Manufacturing" Becomes a Highlight

In respect of intelligent manufacturing, in order to implement the action plan of "Made in China 2025 Strategy", and realize the strategic goal of turning China into an industrial powerhouse, YOFC Qianjiang Company has become the first preform and optical fibre intelligent manufacturing factory in the industry.

YOFC Qianjiang Company has adopted the latest self-developed intelligent process and equipment, and technologies such as intelligent logistics, intelligent warehouse, and MES Manufacturing Execution System. It has set up industrial standards for preform and optical fibre intelligent manufacturing. Based on the connection of MES, ERP, OA, SCM, APS and PLM system, it realized dynamic optimization in the operation process of the whole businesses, and transparency of manufacturing information and management information. Based on full digital workshops operation driven by MES, it realized manufacturing control in the production process and information-based control in production management. Based on the application

of robots and automatic logistics, it realized automation and flexible manufacturing in the whole production process. Through the application of big data technology and expert system, it realized modeling simulation and decision making optimization in craftsmanship and production.

As an important project of the YOFC Qianjiang High-tech Industrial Park, YOFC Qianjiang Company actively exploits intelligent manufacturing of preforms and optical fibres, in order to allow VAD/OVD preform and optical fibre high-speed wire drawing technology developed by YOFC to attain advanced world level, and let optical fibre made in China lead the world. In the future, YOFC Qianjiang Company will continue to focus on the development and technology advancement of the optical fibre preform and optical fibre industry, push ahead the wide application of optical fibre technology, become a front runner in the fields of information transmission and intelligent connection, lead the leap-forward development of the preform and optical fibre industry in China, and give strong support to the implementation of national broadband strategy.

嘉 宾 观 点

💡 长飞公司董事长 马杰



经过近30年的发展，长飞公司已成长为全球光纤光缆行业的领军企业，光纤预制棒、光纤和光缆的销量已经全面实现全球第一。长飞潜江科技园的建设是长飞公司新的中长期战略发展引领下，致力于推动通信产业内涵增长的重要举措。当前，全球

信息化建设持续高涨，光纤光缆需求空前旺盛，光纤光缆市场正处于持续的供不应求状态。科技园一期建设的预制棒和光纤项目，必将依托大好的市场环境，整合产业链最优势资源，稳健发展，致力于成为中国乃至全球最领先的光纤光缆企业。

💡 潜江市市委书记、人大常委会主任 胡功民

长飞公司、日本信越是当今全球光棒光纤制造生产规模最大、技术水平最高的领军企业。两大龙头企业的组团落户，特别是长飞潜江科技园一期正式竣工投产，对我市完善光信息电子产业链条、加快形成新的动能支撑、实现转型升级换道超越具有战略意义。市委、市

政府将一如既往大力支持长飞潜江科技园建设和发展，我们将加强基础设施建设、完善园区功能配套，创造一切便利条件、给予最优政策支持，努力使更多的光棒光纤制造企业和光信息电子企业落户潜江，不断提升潜江打造中国光纤制造之都的内涵。



💡 信越化学工业株式会社社长 齐藤恭彦



佐生博保先生代表致辞

去年3月我们在此进行了开工建设，我们牢记安全第一，同时加快建设步伐，终于在今天这个佳日，我们可以邀请嘉宾们汇聚于此，迎接开业仪式，我感到十分喜悦。目前，伴随数据通信的高速成长，世界范围内光纤的需求也同

时扩大。我们与长飞公司互相协助，坚持安全生产第一的原则，时刻捕捉由于需求扩大带来的优良商机，培育和发展我们的事业，我们成功后一定报答给予我们温暖、理解和有力支持的各位恩人和相关部门。



💡 信越化学工业株式会社常务董事 宫岛正纪

信越化学公司是日本化学产品生产企业中最具国际化观念的企业，集团70%的销售额在海外产出并通过海外子公司展开事业，长飞信越（湖北）光棒公司是我们集团公司中位于中国境内的第14家关联子公司。信越公司和潜江有个

约定，信越希望在潜江展开更宏伟的事业。对于我们而言，潜江是我们心目中的当地，我们要为当地不断的建设和发展做出力所能及的贡献。我们希望，也承诺成为潜江的优秀企业之一，今后也请大家不断给予我们更大力度的支持。

💡 液化空气大中华区副总裁 马瑞龙

长飞潜江科技园充分结合环保理念与智能制造，采用最先进的生产、仓储、物流解决方案，是专为实现光纤预制棒及光纤产品的可持续生产所建设的制造基地。作为新园区的独家气体供应商，液化空气中国将为客户提供可靠的工业气体生产解决方案以及包括氧气、氢气、氮气、

氦气等在内的气体产品。液化空气中国非常自豪能与长飞和信越这两位行业领导者合作，支持他们推进意义深远的产业升级。液化空气中国与长飞的合作始于1998年，近年来我们也在不断拓展双方的合作，我期待这个新园区的投产将我们的战略合作推向新高度。



💡 江汉石油管理局副局长 徐义卫

长飞是全球光纤光缆行业的领先企业，信越是全球领先的预制棒制造企业，液化空气集团是全球工业与医疗保健领域气体、技术和服务的领导者，三家行业领先企业共同入驻江汉盐化工园区，必将为潜江打造全国首屈一指的光纤光缆生产基地、推动区域经济发展增

添强劲动力。江汉油田将一如既往支持地方经济社会发展，支持化工园区建设，加强与长飞集团、信越化学、液化空气集团等企业合作，携手共进、共兴共荣，共同促进盐化工产业园和潜江经济持续健康发展。

💡 长飞公司执行董事兼总裁 庄丹

长飞潜江科技园是长飞公司在湖北省、潜江市和盐化工业园政府大力支持下，在全球范围内整合最领先的产业链资源，构建智能制造，发展循环经济绿色制造的有力探索，将为全球光纤光缆制造树立新的标杆。近年来，信息化对经济的拉动效应已成为全球共识，世界各国都将信

息化建设作为国家建设的重中之重，光纤光缆作为信息传输的关键载体，产业正处于高速发展。在巨大的市场机遇下，长飞公司将狠抓市场机遇，整合全球优势资源，立足中国，辐射全球，将科技园打造成为全球范围内最具影响力的光纤光缆生产和研发基地。



Guest view



Board chairman of YOFC Ma Jie

Through development for nearly 30 years, YOFC has grown into a leading business in global optical fibre and optical cable sector. It has comprehensively achieved the first position in sales of optical fibre preform, optical fibre and

optical cable across the world. The construction of YOFC Qianjiang High-tech Industrial Park is an important measure for YOFC to commit itself to promoting the productivity-induced growth of communication industry under the guidance of new medium and long-term development strategy. At present, global informatization construction is in full swing, the demand for optical fibre and optical cable is unprecedentedly

flourishing and the market of optical fibre and optical cable remains in short supply. The preform and optical fibre project to be built for Phase I of the High-tech Industrial Park must rely on a sound market environment, integrate the most favorable resource, develop in a robust manner and commit itself to becoming a most leading optical fibre and optical cable enterprise in China and even the world.



Secretary of CPC Qianjiang Municipal Committee, Director-general of Standing Committee of Municipal People's Congress Hu Gongmin

YOFC and Shin-Etsu are both leading enterprises with the largest production scale and the highest technical level in optical fibre preform and optical fibre around the world at present time. The grouped settlement of two key businesses at the park, especially the completion and official operation of Phase I project of YOFC Qianjiang High-tech Industrial Park possess a strategic significance for our city to improve the optical information electronic industrial

chain, speed up the formation of new kinetic energy for support and realize the transformation, upgrading, lane-changing transcendence. The municipal Party committee and municipal government will continue its vigorous support to the construction and development of YOFC Qianjiang High-tech Industrial Park. We will strengthen the construction of infrastructure, improve the supporting functions of the park, create all possible convenient

conditions. give the most preferential policy support, endeavor to make more optical preform and optical fibre manufacturing enterprises and optical information electronic enterprises settle at Qianjiang and continuously improve the connotation of building Qianjiang into a capital of Chinese optical fibre manufacturing.



Mr. Sasho Hiroyasu delivers a speech as a representative



President of Shin-Etsu Chemical Co., Ltd. Yasuhiko Saitoh

Last March, we kicked off the construction here. We keep safety first firmly in our mind. Meanwhile, we picked up our pace in the construction. As a result,

on such an occasion, we are honored to invite all the distinguished guests to gather here for greeting the launch ceremony. It gives me a great pleasure. Presently, along with rapid growth of data communication, the demand for optical fibre around the world has also expanded at the same time. We and YOFC assist

to each other, adhering to the principle of work safety first, constantly capturing good opportunities brought by demand expansion, cultivating and developing our cause. After winning success, we will repay all the benefactors and relevant departments which have given us warmth, understanding and vigorous support.



Managing Director of Shin-Etsu Chemical Co., Ltd. Miyajima Masaki

Shin-Etsu Chemical Co., Ltd. is a business with the most internationalized concept among Japanese chemical producers, with 70% sales volume of the Group made abroad

and launched by overseas subsidiaries. YOFC Shin-Etsu (Hubei) Optical Preform Co., Ltd. is our group's 14th associated subsidiary located within the territory of China. Shin-Etsu has an agreement with Qianjiang and wishes to launch a more magnificent cause in Qianjiang. For us, Qianjiang is a local

area in our mind. We are willing to make a contribution to continuous construction and development for local areas in our power. We hope and also promise to become one of the excellent enterprises in Qianjiang. Please continue to give more vigorous support to us in the future.

Vice President of the Greater China Region of Air Liquide Group Marcelo Fioranelli

YOFC Qianjiang High-tech Industrial Park is a manufacturing base specially built for achieving sustainable production of optical fibre preform and optical fibre products by fully combining environment-friendly concept and intelligent manufacturing and adopting the most advanced production, storage and logistic solutions. As an independent gas supplier of the new park,

Air Liquide China will offer reliable industrial gas production solutions and gas products including oxygen, hydrogen, nitrogen and helium etc. for customers. Air Liquide China is very proud of cooperating with such two industrial leaders as YOFC and Shin-Etsu and supporting them in pushing for far-reaching industrial upgrading. The cooperation between Air Liquide China

and YOFC was commenced from 1998. In recent years, we have also been expanding the cooperation between both sides. We are looking forward to pushing our strategic cooperation to a new high after the new park is put into operation.



Deputy Director-general of Jiangnan Petroleum Administration Bureau Xu Yiwei

YOFC is a leading enterprise of optical fibre and optical cable industry in the world. Shin-Etsu is a globally leading preform manufacturing enterprise and Air Liquide is a gas, technology and service leader of

global industry and medical health fields. Three leading enterprises in respective sectors jointly settled in Jiangnan Salinization Industrial Park will surely create a premier optical fibre and optical cable production base for Qianjiang and provide a strong driving force for vigorous economic development of the region.

Jiangnan Oilfield will continue to support the economic and social development of local area, give its support to the construction of industrial park, strengthen the cooperation with YOFC, Shin-Etsu and Air Liquide Group etc., forge ahead hand in hand, thrive together and jointly promote the sustainable.

Executive Director and President of YOFC Zhuang Dan

YOFC Qianjiang High-tech Industrial Park has, under the vigorous support of governments of Hubei Province, Qianjiang Municipality and the Salinization Industrial Park, integrated the most leading industrial chain resources across the globe, launched a vigorous exploration in establishing intelligent manufacturing and developing cyclic economy green manufacturing. The construction of the park will set a new

benchmark for global optical fibre and optical cable manufacturing. In recent years, the pulling effect of informatization upon economy has become a global consensus. Various countries in the world have taken informatization construction as a top priority of national construction. With optical fibre and optical cable as key carriers, the industry is under rapid development. Under the tremendous market's opportunities,

YOFC will firmly grasp each market opportunity, integrate global superior resources, gain a foothold in China, radiate across the globe and build the High-tech Industrial park into an optical fibre and optical cable production and R&D base with the greatest influence around the world.



光纤光缆供不用求 掌握光棒核心技术方是王道

□ 通信世界

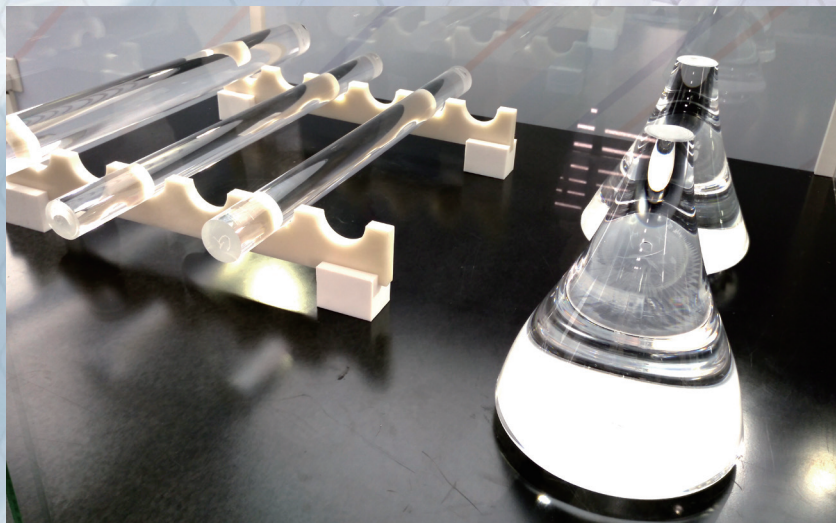
近年来全球光纤光缆行业方兴未艾，“中国速度”更是引人注目，我国已经成为全球最主要的光纤光缆市场和全球最大的光纤光缆制造国。2016年全球约60%光缆产量便来自中国，而近日我国三大运营商也开启了新一轮集采。

运营商对光纤光缆的大量集采促使光纤光缆出现供不应求的局面，光纤光缆的短缺根源还是光纤预制棒短缺。

2017 年光棒产能或达 9000 吨

前瞻产业研究院发布的统计数据显示，截至2016年底国内厂商的光纤预制棒产能为6677吨，预计到2017年将达到9000吨。中国通信企业协会通信电缆光缆专业委员会秘书长段志刚认为，目前光纤预制棒相对短缺，光纤产能大体相当，如果今明两年将扩容能力释放出来，供求关系也许将会发生变化。

从光纤预制棒技术上来看，此前光纤预制棒生产工艺一直掌握在美国、日本及欧洲等发达国家和地区的企业手中。但随着我国光纤光缆市场及技术的成熟，国内主要的光纤光缆企业已掌握了光纤预制棒的生产技术，例如，长飞公司自建厂时便引进了PCVD(等离子体化学气相沉积法)预制棒生产工艺，现已全面掌握PCVD工艺；自主开发的VAD(气相轴向沉积法)工艺平台，打破了国外多年的技术封锁。



需不断补齐短板

我国在光纤预制棒领域已取得显著成绩，但也需要认识到不足之处。工信部通信科技委专职常委毛谦表示，我国在提高光纤预制棒生产效率、良品率方面与国外厂商相比还存在着一定差距，亟待业界不断努力。

在中国联通网络技术研究院网络技术部主任王光全看来，目前我国需求的光纤预制棒的套管大多数还需要进口，为此需要完善光纤预制棒的产业链。这一观点也得到了毛谦的认可，毛谦指出，目前我国制作光纤预制棒很多原料尚不能自给自足，因此在原材料提供、完善产业链等方面要多下功夫。



Optical Fibre and Cable Is in Short Supply and Grasping Core Technology Is the Key

□ Communications World

In recent years, the global optical fibre and cable industry is flourishing. The "Chinese speed" is even more striking. China has become the major optical fibre and cable market and the largest optical fibre and cable producer in the world. In 2016, China produced about 60% of optical cables in the world. Recently, three major communication operators in China have started a new round of procurement.

As communication operators are purchasing optical fibres and cables in large quantity, the optical fibres and cables are in short supply. The fundamental reason for the shortage of optical fibres and cables is the shortage of optical fibre preforms.

Production capacity of preforms is expected to reach 9,000 tons in 2017

According to the statistical data of the Forward Industry Research Institute, the production capacity of optical fibre preforms of manufacturers in China reached 6,677 tons in 2016, and is expected to reach 9,000 tons in 2017. Secretary general of the Telecommunication Cables and Optic Fiber Cables Professional Committee of China Association of Communications Enterprises Duan Zhigang said, now, optical fibre preforms are under short supply. However, the production capacity of optical fibres can meet the demand.

If the expanded production capacity takes effect in this year and next year, the supply-demand relationship might change.

From the perspective of technology of optical fibre preforms, the craftsmanship of optical fibre preforms had been controlled by enterprises in developed countries and regions such as the United States, Japan and Europe for a long time. However, with the development of optical fibre and cable market and technologies in China, major Chinese optical fibre and cable enterprises have grasped production technology for optical fibre preforms. For example, YOFC introduced PCVD (Plasma Chemical Vapor Deposition) preform production craftsmanship when the factory is established. Now, YOFC has grasped the entire PCVD craftsmanship. It self-developed the VAD (Vapour Phase Axial Deposition Technique) craftsmanship platform, and broke through the technology blockade of foreign countries for many years.

We Need to Improve Weak Points

China has made significant achievements in the field of optical fibre preform. However, we should realize our deficiencies. Full time member of the standing committee of the Communication High-tech Industrial Committee of the Ministry of Industry and Information

Technology Mao Qian said, Chinese manufacturers still lag behind foreign manufacturers in production efficiency and good product rate of optical fibre preforms. We should work even harder to catch up.

Director of the Network Technology Research Department of the Network technology research institute of China Unicom Wang Guangquan said, now, Casing pipes for optical fibre preforms needed in China are mostly imported. Therefore, we should optimize the industrial chain of optical fibre preforms. Mao Qian also agreed with him. Mao Qian pointed out, now, many raw materials for producing optical fibre preforms in China need to be imported from other countries. Therefore, we should make more efforts in the fields of raw material supply and optimization of the industrial chain.



多芯光纤制备技术与应用的新进展

□ 特种产品事业部 杨晨 李博睿 童维军

近年来，长飞公司特种产品事业部联合华中科技大学光通信与光网络工程研究团队率先在国内拉制了同质型弱耦合7芯单模光纤，填补了国内在该特种光纤领域的技术空白。

多芯光纤与空分复用技术的兴起

根据贝尔实验室、思科公司等业界巨头对现有光纤网络不同应用的流量增长趋势统计结果，当前光纤通信网络的流量正以20%~60%高速增长。如图1所示，考虑到2010年商用光通信系统实现端口速率100Gb/s，系统容量10Tb/s，在未来十年，光纤通信系统容量将达到100Tb/s左右。然而目前光纤通信系统存在着若干限制：首先，结合低损耗传输窗口和放大器带宽，有用频谱约为10THz；其次，信号在光纤传输中会面临着放大器的自发辐射噪声(ASE)带来的光信噪比恶化，以及由光纤非线性克尔效应带来的非线性损伤，使得系统容量存在非线性香农极限，即通过提高信噪比来提高高频谱效率信号的传输质量会产生非常严重的非线性畸变。

从光信号的本质出发，其物理复用维度包括五个方面（如图2所示），分别为时间、偏振、频率、正交及空间。光纤通信系统中高速信号正在采用多种复用技术，如时分复用、

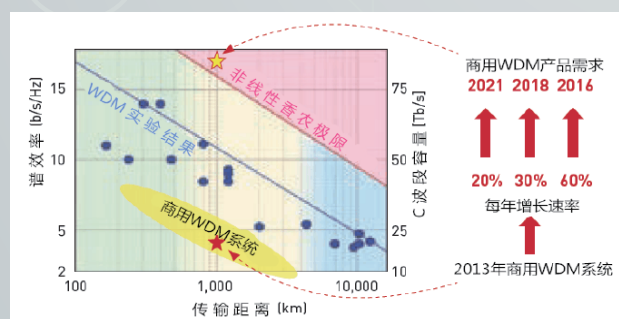


图1 光纤通信系统容量增长趋势

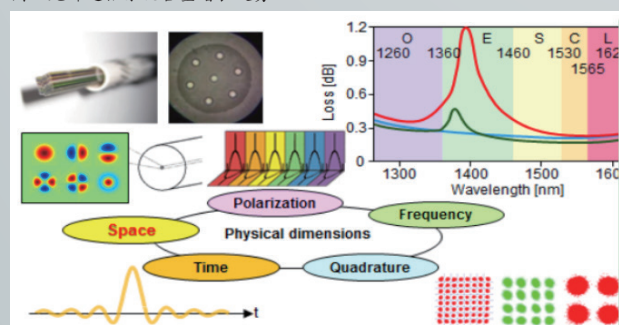


图2 光信号物理复用维度

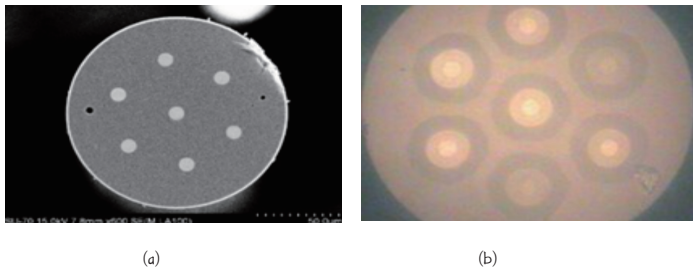


图3 7芯光纤端面电镜图

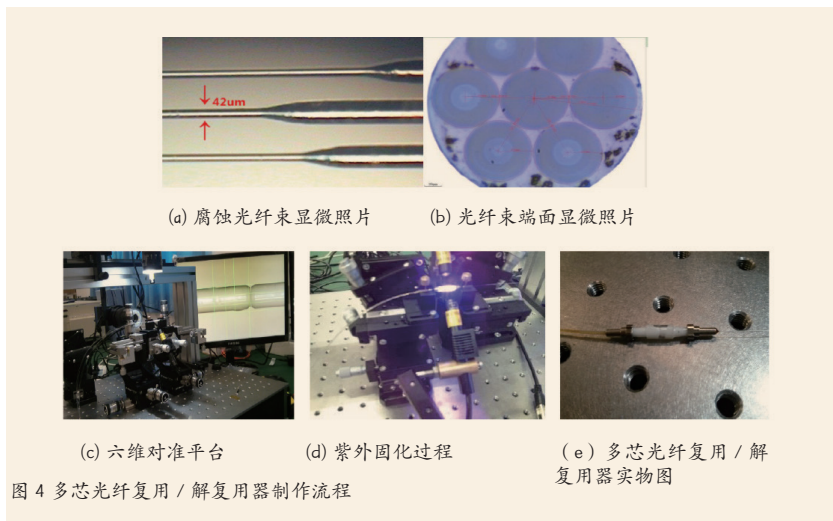


图4 多芯光纤复用/解复用器制作流程

波分复用、偏振复用以及利用相干探测技术的振幅-相位正交复用。而在光纤物理层中唯一未被深入研究的空间维度(space)——空分复用技术(SDM)成为了突破光纤通信系统容量限制的必然选择。

2010年在欧洲光通信会议上,以多芯光纤和少模光纤为基础的空分复用技术(SDM)作为提升光纤通信系统的关键技术得到了众机构科研学者的认同,被视作继波分复用技术之后的光纤传输技术的第二次技术革命。WDM之父厉鼎毅先生对SDM给予很高的评价。

自SDM技术被提出之后,6年来得到了欧美日等国科研机构的高度重视,其中日本情报通信研究机构(NICT)、日本电话电报公司(NTT)牵头,东北大学、北海道大学、大阪大学、住友公司及藤仓公司等机构参与的EXAT项目提出2020年实现光纤通信系统容量千倍跃升的目标。在短短几年的时间里就完成了多批次低损耗、低串扰多芯光纤的设计、拉制以及测试,制作了多种低损耗低串扰的复用/解复用器,并多

次在OFC、ECOC等国际会议上报导英雄传输实验。在欧洲,欧盟针对空分复用技术的研究建立了MODE-GAP项目,联合了包括南安普顿大学、阿斯顿大学、埃因霍温理工大学等多家大学和公司,重点开展基于少模光纤的空分复用技术的研究,尤其是基于少模光纤的复用/解复用器件的制作和开发,并迅速地将其产业化。在美国,贝尔实验室等科研机构利用康宁公司、OFS公司研制的多芯光纤、少模光纤,报导了大量的传输实验结果,并实现了空分复用实时传输实验,标志着空分复用传输从实

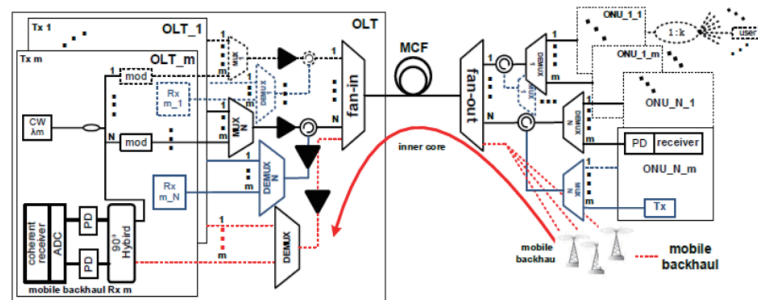


图5 新型波分/空分接入网架构

验室理想环境走向了更复杂的现场实时传输。

多芯光纤及其复用器件的制备技术新进展

由于基于少模光纤的空分复用技术需要在相干接收机采用极其复杂的DSP算法,且模式相关损耗会显著降低传输性能等本质特征(且这些特征随着传输距离的增加,模式复用数目的增加而急剧劣化),我们选择了应用前景更为明朗,更有利于在中短期解决现有光纤通信系统容量瓶颈的多芯光纤空分复用技术。

长飞光纤光缆股份有限公司通过与华中科技大学光通信与光网络工程研究团队合作,率先在国内拉制了同质型弱耦合7芯单模光纤。通过对7芯波导结构的仿真计算,拉制了两种同质型多芯光纤,即非低串扰与低串扰的7芯光纤,其电镜图如图3所示。通过对光纤衰减谱、截止波长、弯曲损耗、串扰、色散、PMD等性能参数的测试,不断优化工艺,最终实现低串扰、低损耗的7芯光纤。光纤在1550nm的为衰减0.20dB/km左右,串扰低于-40dB/100km,填补了国内在该特种光纤领域的技术空白,在产品性能上与国际领先的OFS、康宁、藤仓等众多光纤厂商接近。

另一方面,适用于多芯光纤的空间复用/解复用器至关重要,因为在收发两端及网络节点,仍然是基于单模光纤的器件,因此有必要将多路单模光纤中的信号复用进多芯光纤,并将多芯光纤中的多路并行信号解复用到多路单模光纤中。针对多芯光纤复用/解复用器,在综合比较了国际上主流技术的利弊之后,

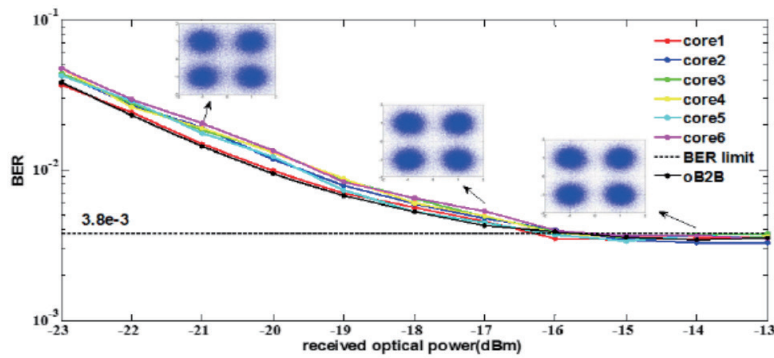
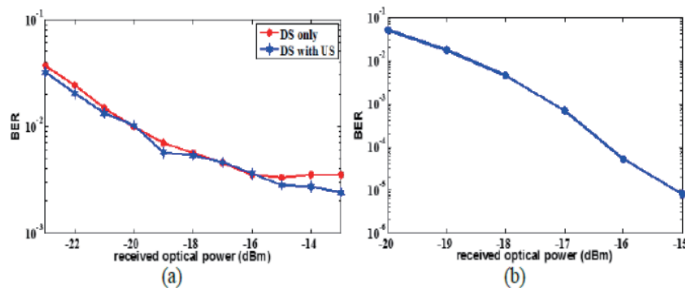
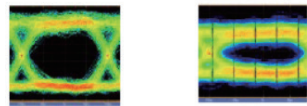


图6 下行传输结果



(a) 在上行传输存在的条件下的下行信号传输结果 (b) 上行信号传输结果



(c) -8dBm 和 -15dBm 接收功率时的眼图

图7 上行传输结果

结合自身条件，选择了光纤束冷接工艺的技术方法来实现复用/解复用器。

在复用/解复用器的制备上，主要通过光纤预处理→光纤束预组装→在线空间对准→封装等工艺步骤来实现。具体流程如图4所示。经过不断的工艺优化，最终实现插入损耗<1.5dB，串扰<-45dB，回波反射<-50dB，在综合性能指标上达到了国际先进水平。

凭借高质量的多芯光纤复用/解复用器，长飞多芯光纤一方面很快打开了国内国际市场，得到了客户的青睐，并受到了清华大学、暨南大学、北京科技大学、香港理工大学、瑞典查尔姆斯大学、以及美国Chiral Photonics公司等的一致好评。

多芯光纤的应用试验

基于上述多芯光纤及复用器件，

我们在通信传输方面做了一些应用的试验工作。

首先，针对当前空分复用大容量接入网距离短、速率低、调制格式低级，普遍采用时分复用的研究现状，搭建了多芯光纤传输平台，由光频梳作为下行光源，调制高阶格式信号，经过6个外层芯传输到ONU端；在ONU端，

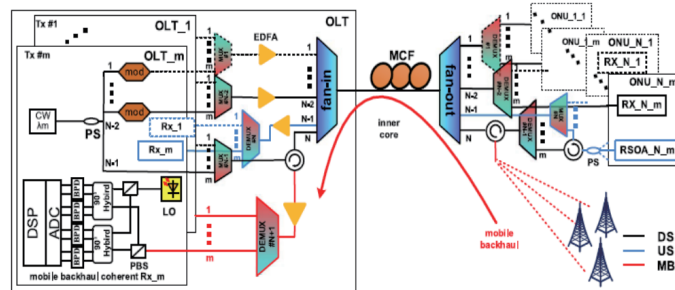


图8 波分/空分接入网架构示意图

上行采用可调激光器作为光源，调制OOK信号，同样经过6个外层芯传输。为了降低成本，对上下行信号采用直调直检技术。为了兼容移动回传业务，在中间芯传输移动回传信号，并在OLT端进行相干接收，从而实现兼容移动业务新型大容量波分/空分接入网架构（如图5所示）。初步实现在58公里多芯光纤下行传输容量300Gb/s，支持60个用户，每个用户5Gb/s。实验结果如图6、图7所示。

其次，在此架构基础上进行了优化改进，一方面通过在接收端采用RSOA实现低成本无色ONU，另一方面采用更高级调制格式以及自适应调制增加系统容量。在新的架构中，下行信号在调制后经过外层5个芯传输到ONU端，对于上行信号的载波，通过外层第六个芯单独进行传输到ONU端进行RSOA再调制后，从中间芯进行传输。另外，对于移动回传信号，采用偏振复用以增加容量，速率达到48Gb/s。该接入网架构如图8所示。实验示意图如图9所示。在实验中，由于RSOA带宽有限，采用注水算法对其进行自适应调制OFDM信号，使其在1.25G带宽下传输速率达到3.12Gb/s。最终实现下行50个用户，单个用户接入速率5Gb/s，系统容量达到250Gb/s。上行速率达到3.12Gb/s，且兼容移动回传业务，容量达到48Gb/s，实验结果如图10、图11所示。

未来发展方向与展望

空分复用光纤通信技术成为业界主流的选择将是一个漫长的过程，期间

既有运营商、系统供应商对现有单模光纤通信技术的潜能继续挖掘，也会包括彼此之间的博弈，权衡取舍。

从空分复用技术自身角度来讲，一方面需要不断改善空分复用器件性能，尽快制定相关标准。目前基于多芯光纤的空分复用系统不断得到完善，日本住友公司已经拉制出超低损耗多芯光纤，藤仓公司也拉制出22芯、30芯等更多数目的多芯光纤。复用/解复用器日益的集成化、小型化，多芯光纤熔接技术、连接器、放大器都日臻完善。另一方面，空分复用技术需要找到更适合自己特点的应用场景，譬如，多芯光纤的特点之一就是空间利用率高，性能近似于多根单模光纤的同时可以节省更多空间，那么这一特点就非常适用于对空间敏感的数据中心的应用。

随着云计算的风靡，互联网巨头规划建设了越来越多的大型数据中心，多芯光纤具有非常大的潜能，发挥用武之

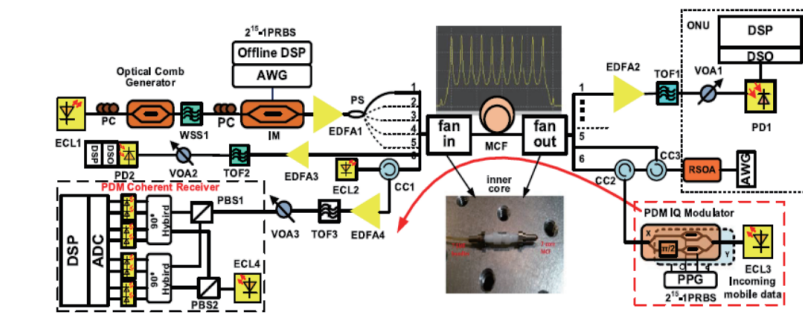


图9 实验示意图

地。随着移动通信技术的发展，基于移动通信网络的丰富应用带动了移动数据业务的大幅度增长，为了在大幅度扩容时同时满足绿色和低成本运营要求，5G无线网络的频谱效率和能量效率都需要在4G标准上提高一个数量级。而未来5G通信中关键技术之一就是大规模阵列天线多输入多输出技术（Massive MIMO），假设阵列天线由128根天线

组成，信号带宽100MHz，采用16bits量化和8b/10b编码，则其与基带池链路的数字复合速率将高达786Gbps。因此基于光纤的光载无线（RoF）传输技术将是未来移动通信传输的关键技术。目前国际上关于5G关键技术的研发开展的如火如荼，而空分复用技术将会丰富其技术方案的选择，甚至有潜力成为其中的关键技术。

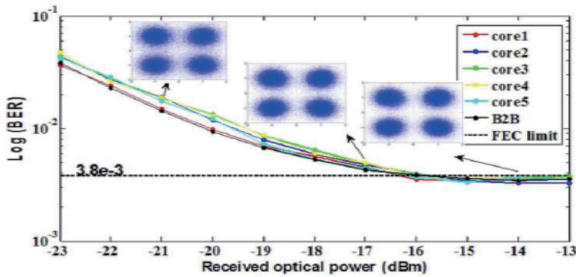


图10 下行传输实验结果图

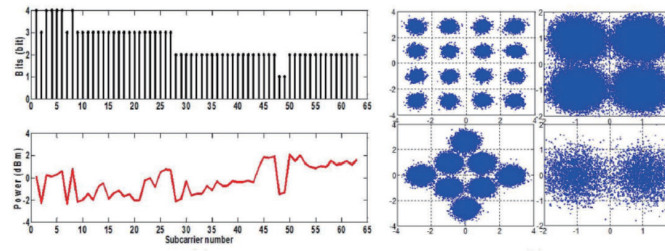


图11 上行信号经过RSOA自适应调制结果示意图





New Progress Made in Multi-Core Optical Fibre Fabrication Technique and Application

□ Yang Chen, Li Borui and Tong Weijun from Special Product Division

In recent years, YOFC Special Product Business Division has been cooperating with Optical Communications and Optical

Network Engineering Research Team of HUAZHONG UNIVERSITY OF High-tech Industrial to take the lead in the drawing of

polymorphic weak-coupling 7-core single-mode fibre which fills in the technical gap in the field of special optical fibre.

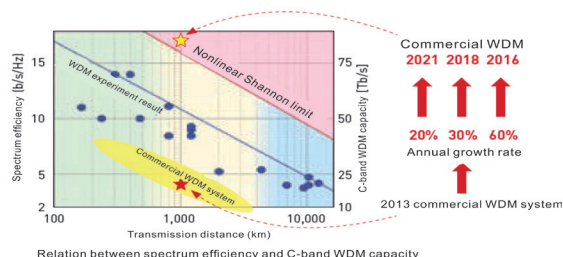


Fig. 1 Optical Communication System Capacity Growth Trend

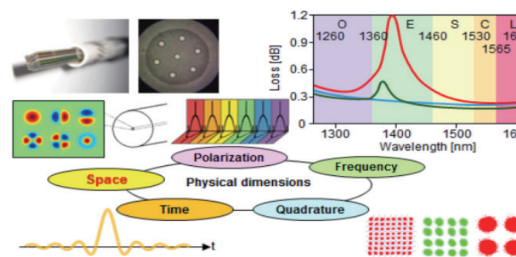


Fig. 2 Optical Signal Physical Multiplexing Dimension

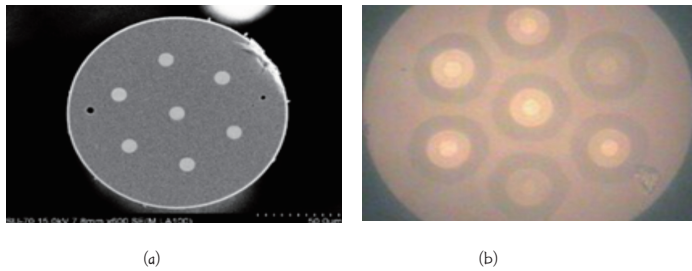


Fig. 3 Electron Micrograph of 7-Core Optical Fiber End Face

The rise of multi-core fibre and spatial division multiplexing technique

According to the statistical result of traffic growth trend in different applications of current optical network provided by magnates of the industry including Bell Labs and Cisco, the traffic of current optical communication network is growing rapidly in a rate of 20%~60%. As shown in Fig. 1, considering that the port rate of commercial optical communication system was 100Gbit/s and system capacity was 10Tbit/s in 2010, the capacity of optical communication system will be about 100Tbit/s in future 10 years. However, there are several limitations in the current optical communication system: Firstly, combining low-loss transmission window and amplifier band width, the effective spectrum is about 10THz; secondly, the signal may encounter optical signal noise

ratio (OSNR) degradation due to spontaneous emission (ASE) noise of amplifier and nonlinear damage due to nonlinear Kerr effect of optical fibre and, as a result, the system capacity has nonlinear Shannon limit, i.e. very serious nonlinear distortion may be caused if the transmission quality of high spectral efficiency signal is improved by increasing the signal-to-noise ratio.

To consider from the nature of optical signal, its physical multiplexing dimension includes five factors (as shown in Fig. 2), i.e. time, polarization, frequency, orthogonality and space. High-speed signal in optical communication system is using several multiplexing technique, such as time division multiplexing, wavelength division multiplexing, polarization multiplexing and amplitude-phase orthogonal multiplexing using coherent detecting technique. While, the only dimension that has not been

researched in depth in physical layer of fibre is space, i.e. spatial division multiplexing (SDM) technique becomes the inevitable choice to break through the limitation of optical communication system capacity.

At the European Conference on Optical Communication in 2010, the spatial division multiplexing (SDM) technology on the basis of multi-core fibre and few-mode fibre gained the recognition of research scholars from different institutions as the key technology to improve optical communication system and it was considered as the second technical revolution in optical fibre transmission technique as wavelength division multiplexing technique. Mr. Li Dingyi, the Father of WDM, spoke highly of SDM.

Since the emerging of SDM technique, it has been given high attention by scientific research institutions from many countries and regions including, Europe, U.S. and Japan in 6 years. Leading by National Institute of Information and Communications Technology (NICT) and Nippon Telegraph & Telephone (NTT), the EXAT Project participated by several institutions including NORTHEASTERN UNIVERSITY, HOKKAIDO UNIVERSITY, OSAKA UNIVERSITY, SUMITOMO and Fujikura proposed the objective to realize thousand-time booming of capacity of optical communication system in 2020. Within only a few years, the design, drawing and test of several batches of low-loss, low cross-talk, multi-core fibres have been completed, several kinds of low-loss and low cross-talk multiplexers/demultiplexers have been made and hero transmission experiments have been reported at international conferences including OFC and ECOC for several times. In Europe, the EU established MODE-GAP Project for the research of spatial

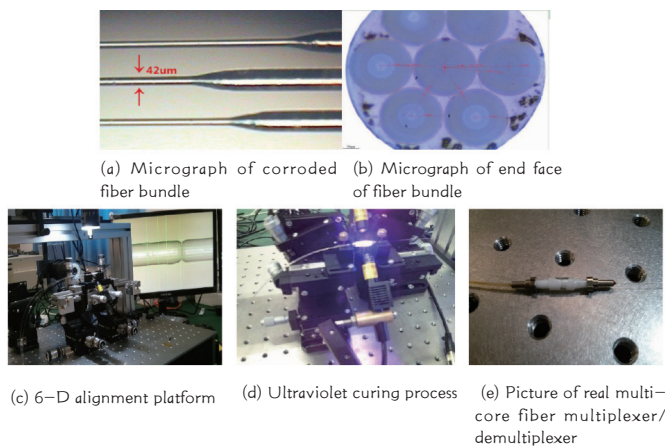


Fig. 4 Manufacturing flow of multi-core fiber multiplexer/demultiplexer

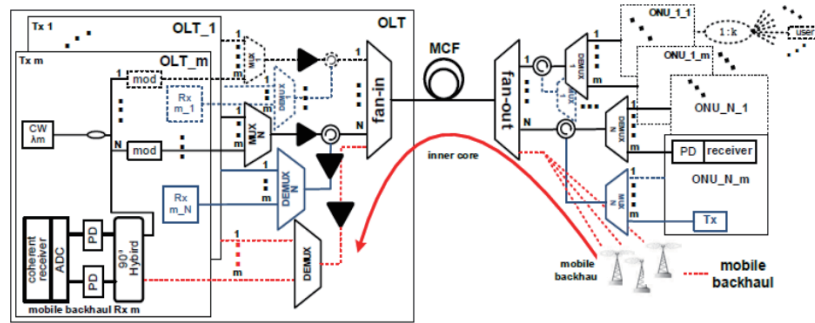


Fig. 5 New Wavelength Division/Spatial Division Access Network Architecture

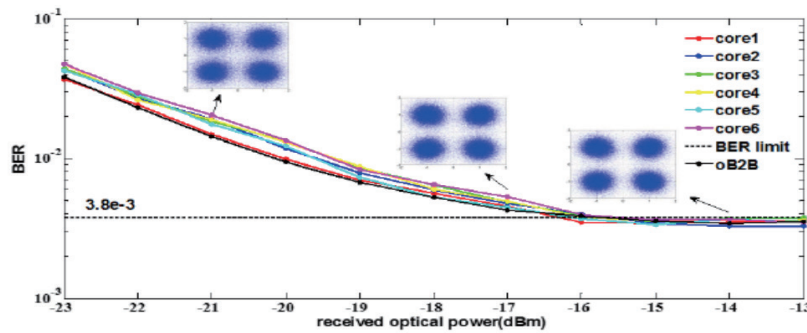


Fig. 6 Downstream Transmission Result

division multiplexing technique and allies with several universities and companies including University of Southampton, Aston University and Technische Universiteit Eindhoven to pay special attention to the research on few-mode fibre based spatial division multiplexing technique, especially the manufacturing and development of few-mode fibre based multiplexer/demultiplexer, and industrialize them rapidly. In the U.S., scientific research institutions including Bell Labs reported lots of transmission experiment results and realized the spatial division multiplexing real time transmission experiment with the multi-core fibre and few-mode fibre developed by Corning and OFS. This marked the transfer of spatial division multiplexing transmission from ideal environment in labs to more complex site real time transmission environment.

New Progress Made in Multi-core Optical Fibre and Multiplexer Fabrication Technique

Since the few-mode fibre based spatial division multiplexing

technique needs to adopt extremely complex DSP algorithm in coherent receiver and the mode related loss reduces the substantive characteristics including transmission performance significantly (and those characteristics may be degraded rapidly with the increase of transmission distance and the number of multiplexed modes), we choose multi-core fibre spatial division multiplexing technique that has certain prospects and is more beneficial to break through the bottleneck of capacity of current optical communication system in a middle or short term.

Yangtze Optical Fibre and Cable Joint Stock Limited Company cooperates with Optical Communications and Optical Network Engineering Research Team of HUAZHONG UNIVERSITY OF High-tech Industrial to take the lead in the drawing of polymorphic weak-coupling 7-core single-mode fibre. Two types of polymorphic multi-core fibres, i.e. non-low-cross-talk/low cross-talk 7-core fibre, are drawn through 7-core waveguiding structure simulating calculation. The electron micrograph is as shown in Fig. 3. Optimize processes constantly by testing performance parameters including fibre attenuation

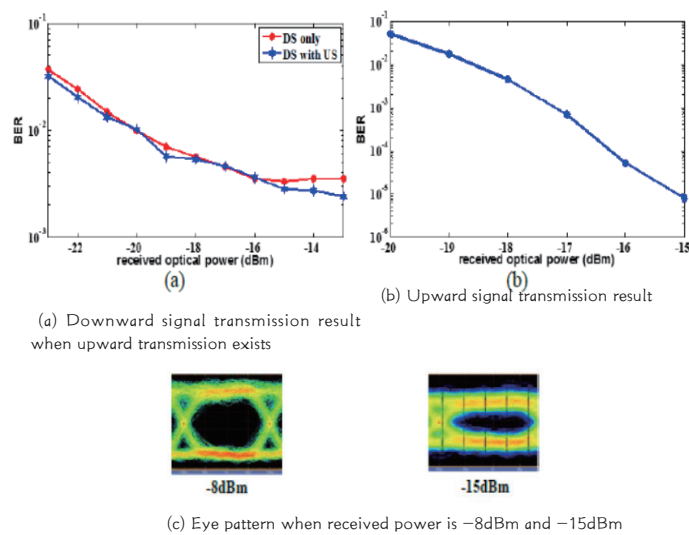


Fig. 7 Upward Transmission Result

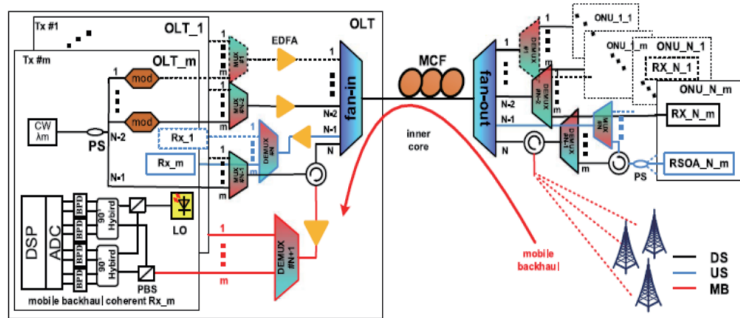


Fig. 8 Diagram of Wavelength Division/Spatial Division Access Network Architecture

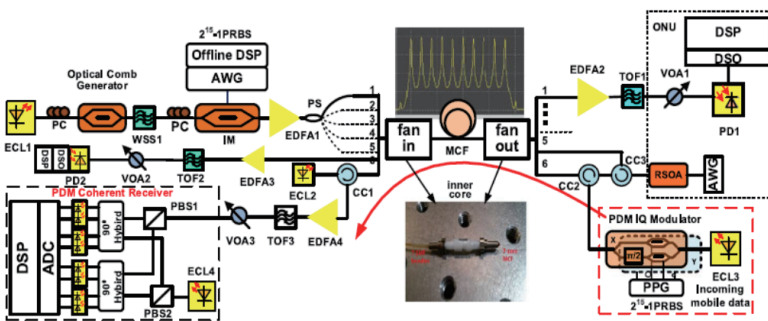


Fig. 9 Experiment Diagram

spectra, cutoff wavelength, bending loss, cross-talk, dispersion and PMD, so as to realize low cross-talk and low-loss 7-core fibre. The attenuation of optical fibre at 1,550nm is about 0.20dB/km and the cross-talk is lower than -40dB/100km. This fills in the technical gaps in domestic special optical fibre field and makes it close to world leading optical fibre manufacturers including OFS, Corning and Fujikura in terms of product performance.

On the other hand, the spatial multiplexer/demultiplexer applies to multi-core fibre is very important. Since it still is single mode fibre based devices at the transmit-receive ends and network nodes, it is necessary to multiplex signals in several single mode fibres into multi-core fibre and demultiplex the multi-path parallel signals in multi-core fibre to several single mode fibres. For multi-core fibre multiplexer/demultiplexer, after comprehensive comparison of

international mainstream techniques and combining our own condition, fibre bundle cold connection technique was adopted to realize multi-core fibre multiplexer/demultiplexer.

The preparation of multiplexer/demultiplexer is mainly realized by adopting processing steps including pretreatment of optical fibre → preassembly of fibre bundle → online spatial alignment → capsulation. The specific process is as shown in Fig. 4. Through constant process optimization, insertion loss < 1.5dB, cross-talk < -45dB and reflection < -50dB are realized finally and international advanced level is achieved in terms of comprehensive performance index.

With high-quality multi-core

fibre multiplexer/demultiplexer, we open the domestic and international market, win the favor of customers and obtain unanimous praise of TSINGHUA UNIVERSITY, JINAN UNIVERSITY, University of High-tech Industrial Beijing, THE HONG KONG POLYTECHNIC UNIVERSITY, Chalmers University of Technology and Chiral Photonics Company.

Multi-Core Fibre Application Test

On the basis of the aforementioned multi-core fibre and multiplexer, we carried out several application tests in terms of communication transmission.

First, due to the current research status (short distance between large capacity access networks of spatial division multiplexing, low rate, low level of modulation format and general use of time division multiplexing), multi-core fibre transmission platform is established to use optical frequency comb as downward light source to modulate high-order format signal and transmit it to ONU end by passing through 6 outer cores; at the ONU end, in the upward direction, tunable laser shall be used as the light source to modulate OOK signal and also transmit it by passing through 6 outer cores. To reduce cost, the upward and downward signals shall adopt intensity modulation and direct detection technique. To be compatible with Mobile Backhaul business, the Mobile Backhaul signal shall be

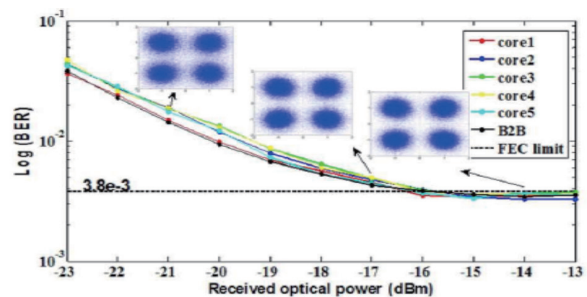


Fig. 10 Downstream Transmission Experiment Result

transmitted in the middle core and coherent reception shall be done at OLT end, so as to realize new large-capacity wavelength division/spatial division access network architecture compatible with Mobile Backhaul (as shown in Fig. 5). Realize a downward multi-core fibre transmission capacity of 300Gbit/s at 58 km to support 60 users (5Gbit/s for each user). The experimental result is as shown in Fig. 6 and Fig. 7.

Second, optimization and improvement are made on the basis of this architecture. On one hand, adopt RSOA at receiving end to realize low-cost colorless ONU; on the other hand, adopt higher level of modulation format and adaptive modulation to increase system capacity. In the new architecture, the modulated downward signal will pass through 5 outer cores to be transmitted to ONU end. For the carrier wave of upward signal, it will pass through the 6th outer core to be transmitted to ONU end individually to accept RSOA remodulation and be transmitted through the middle core. Besides, for Mobile Backhaul signal, polarization multiplexing shall be adopted to increase capacity and the rate will reach 48Gbit/s. The architecture of this access network is as shown in Fig. 8. The experiment diagram is as shown in Fig. 9. During the experiment, since the RSOA band width is limited, water-filling algorithm shall be adopted for adaptive modulation of OFDM signal, so as to make sure that the transmission rate can reach 3.12Gbit/s when the band

width is 1.25G. Finally, in the downward direction, 50 users shall be realized and each user can be provided with access rate of 5Gbit/s and the system capacity can be 250Gbit/s. The upward rate can be 3.12Gbit/s, Mobile Backhaul business is compatible and the capacity can be 48Gbit/s. The experimental result is as shown in Fig. 10 and Fig. 11.

Future development Direction and Outlook

It will be a long process to make spatial division multiplexing fibre communication technology the mainstream choice of the industry. During this process, operators and system suppliers can excavate the potential of existing single mode fibre communication technology continuously and they may play games with each other and face trade-offs.

To see from the spatial division multiplexing technique itself, on one hand, the performance of spatial division multiplexer needs to be improved constantly and develop relevant standards as soon as possible. At present, multi-core fibre based spatial division multiplexing systems are being improved constantly. Sumitomo Company has drawn ltra-low-loss multi-core fibre and Fujikura Company has drawn multi-core fibres with 22 or even 30 cores. With the increasing integration and miniaturization of multiplexer/demultiplexer, the multi-core fibre fusion welding technology, connectors and amplifiers are all becoming better and approaching perfection day by day. On the other

hand, spatial division multiplexing technique needs to be used in an application scenarios more appropriate to its characteristics, for example, one of the characteristics of multi-core fibre is high utility rate of space, its performance is similar to that of several single mode fibres, at the same time, more space can be saved; then, this characteristic is well-suited for the application in spatial sensitive data center.

With the popularity of cloud computing, Internet giants planned and constructed more and more large-scale data centers and the multi-core fibre has very considerable potential to come to play. With the development of mobile communication technology, mobile communication network based applications drive the substantial increase of mobile services. To meet the green and low-cost operation requirements while large-scale capacity expansion, the spectral efficiency and energy efficiency of 5G wireless network shall raise one order of magnitude on the basis of 4G standard. While, one of the key technologies to be used in future 5G communication is massive array antenna Multi-Input Multi-Output (Massive MIMO) technique. If we assume that the array antenna consists of 128 antennas, the signal band width is 100MHz, 16bits is adopted for quantification and 8b/10b is adopted for coding, then its digital compound rate with baseband pooling link will be 786Gbps. Therefore, fibre based radio over fibre (RoF) transmission technique will be the key technology used in future mobile communication transmission. At present, the research and development of 5G key technology is carried out in full swing internationally and spatial division multiplexing technique will provide more choices of technical proposals and even has the potential to become a key technology.

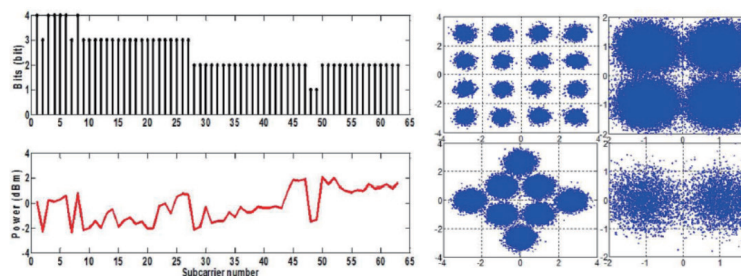


Fig. 11 Diagram of RSOA Adaptive Modulation Result of Upstream Signal



下一代数据中心建设： SWDM技术与宽带多模光纤

□ 研发中心 肖武丰

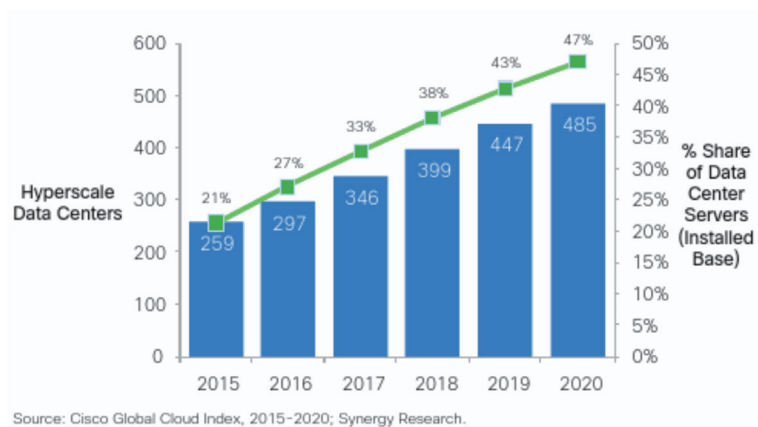
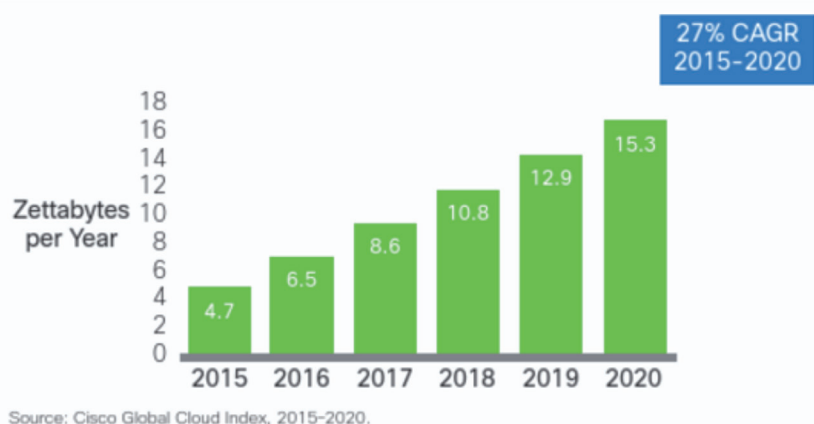


图1 全球数据中心 IP 流量增长和数据中心增长

近年来，网络数据通信量增长迅速。2016年思科发布的《2015-2020全球年度云指数报告》显示，2015年的网络数据总流量为4.7ZB，而这一数值在2020年将增长3.25倍，达到15.3ZB。同时，思科预计，全球范围内的思科超级数据中心将从2015年的259个增长到2020年的485个，超级数据中心的数据流量也将在未来的5年间增长5倍。因此，数据中心对带宽的要求越来越高，下一代数据中心的建设需要成本更低、带宽更宽的传输介质，如图1所示。在短距离应用中，垂直腔面发射激光（VCSEL）光源的成本优势，使得多模光纤依然是数据中心首选的性价比较高的布线介质。

与此同时，IEEE目前正在开发100Gbps，200Gbps以太网标准，主要应用于数据中心网络主干；400G

主要用于运营商中心机房，400G以太网的标准预计于2017年颁布。支持850nm-950nm短波波分复用（Shortwave wavelength division multiplexing, SWDM）技术的宽带多模光纤（Wide band multimode fiber, WBMMF）是实现数据中心100G网络传输的优质解决方案，同时也能为未来可能出现的更高速200G乃至400G以太网提供余量空间。2016以太网路线如图2所示。

SWDM 技术与 SWDM 联盟

● SWDM 技术

短波波分复用（如图3所示）就是借鉴单模光纤的波分复用（WDM）技术，扩展传输时所用的波长范围，从传统的多模光纤所用的850nm扩展至850nm-950nm，利用性价比高的短波的垂直腔面发射激光（VCSEL）光源和优化的宽带多模光纤（WBMMF），在一根多模光纤上支持四个波长传输数据，把需要的光纤芯数降低为原来的1/4，同时提高光纤的有效模式带宽（Effective Modal Bandwidth, EMB），延长传输距离。

当波长大于850nm时，多模光纤的色散带宽增加，传输距离提高。SWDM技术采用的工作波长从850nm开始，每隔30nm增加一个波长，即：880nm，910nm和940nm，因而宽带多模光纤工作波长位于850nm-950nm范围内。在短波波分复用模块中，4个VCSEL

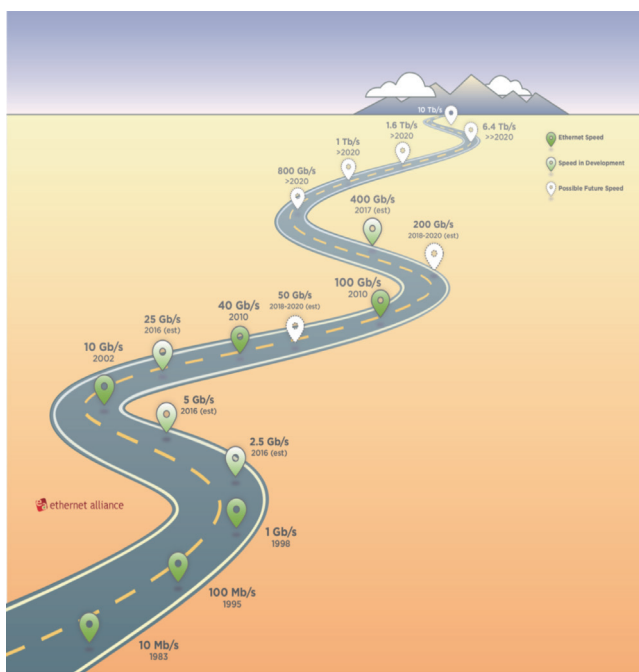


图2 2016 以太网路线

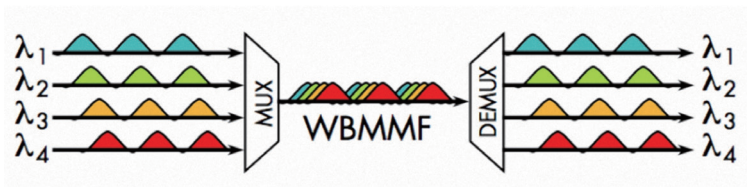


图3 短波分复用



图4 SWDM 联盟

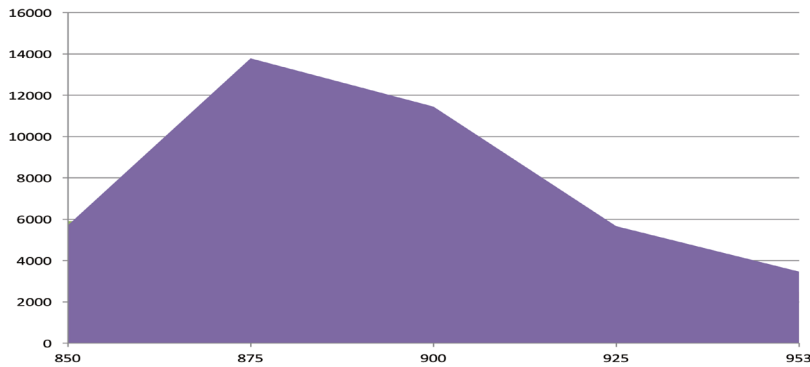


图5 OM5 标准 (TIA) 和 OM4、OM5 光纤的有效模式带宽

表1 TIA 标准中对多模光纤的带宽要求

光纤	OMB (MHz*km)			EMB (MHz*km)	
	at 850 nm	at 953 nm	at 1300 nm	at 850 nm	at 953 nm
OM3	1500	-	500	2000	-
OM4	3500	-	500	4700	-
OM5	3500	1850	500	4700	2470

产生4个不同波长的光信号，复用到单条链路上，所有的VCSEL和光耦合在光模块中进行。在模块的接收端，信号被解复用，并转化为平行的电信号。采用并行的两根光纤，即可完成一发一收的数据传输。

- SWDM 联盟 (如图4所示) 作为一种能够大大提升多模光纤

传输容量并增加传输距离的新技术，SWDM对于数据中心建设以及相关光纤、器件和设备厂家的意义不言而喻。在2015年，包括康普、康宁、戴尔、Finisar、H3C华三、华为、Juniper、Lumentum和OFS在内的九家公司成立了SWDM联盟，此后不少国内外厂家加入该联盟。目前，在该联盟成员包括长飞、康宁、OFS、Prysmian、康普等

光纤和布线厂家，还包括戴尔、华为、华三、Juniper等设备厂家和Finisar、Lumentum等模块厂商。

该联盟致力于促进SWDM技术的发展和推广，促进SWDM光模块在WBMMF宽带多模光纤的使用。SWDM联盟表示他们将首先着重与40Gbps的4*10Gbps和100Gbps的4*25Gbps的应用需求，并将在今后进一步拓展到400Gbps应用。该联盟表示，他们不会参与标准制定，也没有计划成立光模块MSA。该组织也将避免市场分割、定价和竞争等问题。

宽带多模光纤

OM3光纤的有效模式带宽(EMB)是2000MHz*km，OM4光纤的有效模式带宽达到4700MHz*km，随着100G、200G和400G以太网的提出，传统的多模光纤在芯数和距离上成为阻碍未来以太网络发展的瓶颈。宽带多模光纤的出现打破了传统多模光纤的技术瓶颈，是实现SWDM技术的关键所在。宽带多模光纤支持850nm-950nm，能够在同一根多模光纤上传输4个波长，提高传输速率，降低光纤芯数，延长传输距离。同时宽带多模光纤可以与传统的OM3和OM4多模光纤兼容，在传统应用方面与OM4有同样优秀的表现。

宽带多模光纤在TIA标准中称为OM5，在IEC标准中叫做A1a.4，IEC正式标准预计今年下半年发布。2016年发布的TIA-492AAAE-2016标准中，与OM4多模光纤相比，OM5光纤增加了953nm的满注入带宽(OMB)和有效模式带宽(EMB)要求，如表1所示。满注入带宽的光源为LED，有效模式带宽的光源为VCSEL。单位为MHz*km，即带宽和距离的乘积，可以简单地理解为信号传输速率小则传得远，而传输速率大传得近。

相对于OM4而言，OM5光纤在长波长范围内的带宽要求更高，以满足SWDM技术的需要。长飞生产的OM5光纤具体参数如图5所示。对比TIA标准



图 6 SWDM MSA

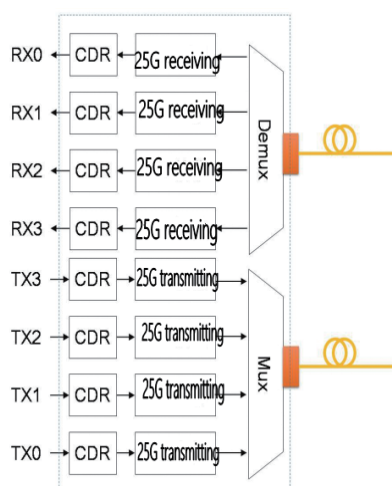


图 7 100G 光模块框图

和OM4光纤的特征曲线，OM5光纤的有效模式带宽远高于标准。

SWDM MSA

SWDM多源协议（Multisource Agreement, MSA）是致力于定义SWDM光收发机的光学参数并促进其应用的产业联盟。其成员包括以下六家公司，如图6所示。

● 传输速率

今年三月，100G短波波分复用多源协议(SWDM MSA)组首次发布了40G和100G的两个SWDM标准。MSA定义了用于以太网的100Gbit/s的光收发机的4x10Gbps和4x25Gbps的SWDM光接口。对于40G，两个收发机间的多模光纤长度范围为2m至440m，单方向上的每个通道的信号速率为10.3125Gbps。在100G标准中，为了保证系统的可靠性，需要增加前向纠错模块。两个收发机间的多模光纤长度范围为2m至150m。单方向上的每个通道的信号速率为

25.78125Gbps。

● 传输距离

对OM3、OM4和OM5多模光纤而言，在40G的工作范围最小为2m，最大传输距离分别为240m、350m

表 2 宽带多模光纤的传输距离

多模光纤类型	40G传输距离(m)	100G传输距离(m)
OM3	240	75
OM4	350	100
OM5	440	150

表 3 40G SWDM4 链路指标

主要参数	OM3	OM4	OM5	
传输距离 (m)	240	350	440	
插入损耗 (dB)	2.4	2.8	2.9	
通道代价 (dB)	L0:850 nm	2.4	2.8	2.9
	L1:880 nm	2.3	2.6	2.7
	L2:910 nm	2.2	2.5	2.6
	L3:940 nm	2.1	2.5	2.5

表 4 100G SWDM4 链路指标

主要参数	OM3	OM4	OM5	
传输距离 (m)	75	100	150	
插入损耗 (dB)	1.8	1.9	2	
通道代价 (dB)	L0:850 nm	1.8	1.9	2.0
	L1:880 nm	1.8	1.9	1.9
	L2:910 nm	1.8	1.8	1.9
	L3:940 nm	1.7	1.8	1.9

和440m。在100G的工作范围最小是2m，OM3、OM4和OM5多模光纤的最大传输距离分别为75m、100m和150m，如表2所示。

● 光模块框图

SWDM4模块包括以下几个部分：四个不同波长的光发射机，四个带有信号探测器的光接收机，波分复用器和解复用器，多模光纤双工光连接器。100G的光模块框图如图7所示。

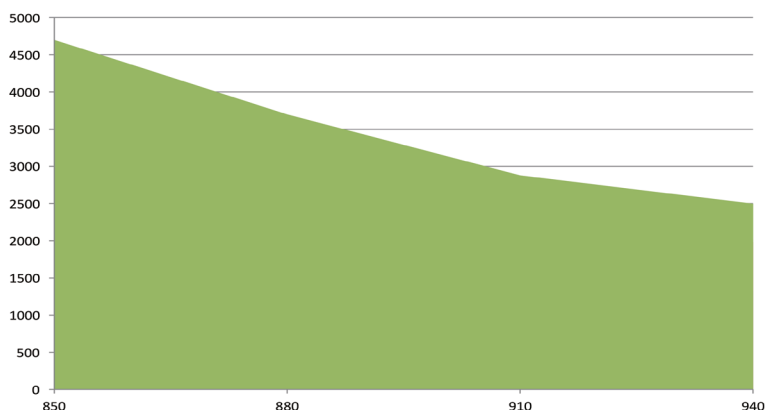


图 8 40G SWDM4 中 OM3、OM4 和 OM5 的有效模式带宽要求

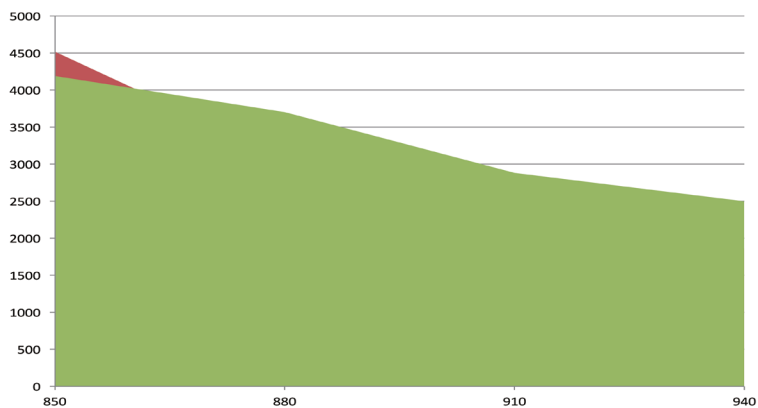


图 9 100G SWDM4 中 OM3、OM4 和 OM5 的有效模式带宽要求

● 链路指标

40G短波（850~940nm）波分复用多源协议中链路指标如表3所示。

SWDM MSA小组发布的标准相对于TIA针对多模光纤的标准略有不同，40G SWDM4的有效模式带宽要求如图8所示。

100G短波（850~940nm）波分复用多源协议中链路指标如表4所示。

100G SWDM4的有效模式带宽要求如图9所示。

总结

短波波分复用技术（SWDM）和宽带多模光纤（WBMMF）具有更高的传输速率，更长的传输距离，更少的光纤芯数，以及较低的布线成本。对于下一代数据中心建设，SWDM和WBMMF仍然是数据中心40/100以太网的主流传输介质。进一步将短波波分复用和并行传输技术相结合，只需要8芯宽带多模光纤，就能够支持更高速的应用，比如200/400G以太网。





Construction of the Next Generation of Data Centers: SWDM Technique and Wide Band Multimode Fibre

□ Xiao Wufeng From R&D Center

In recent years, network data traffic has increased rapidly. Cisco issued Cisco Global Cloud Index, 2015-2020 in 2016 and this report showed that the total network data traffic in 2015 was 4.7ZB and it will be 15.3ZB, 3.25 times the current value, till 2020. At the same time, Cisco predicated that the mega data centers of Cisco would increase from 259 in 2015 to 485 in 2020 globally and the data traffic of the mega data centers would increase by 5 times in the future 5 years. Therefore, data centers have growing demands on bandwidth. For the construction of the next generation of data centers, transmission media with lower cost and wider bandwidth, as shown in Fig. 1, are needed. In short-distance application, the cost advantage of vertical-cavity surface-emitting lasers (VCSEL) source guarantees

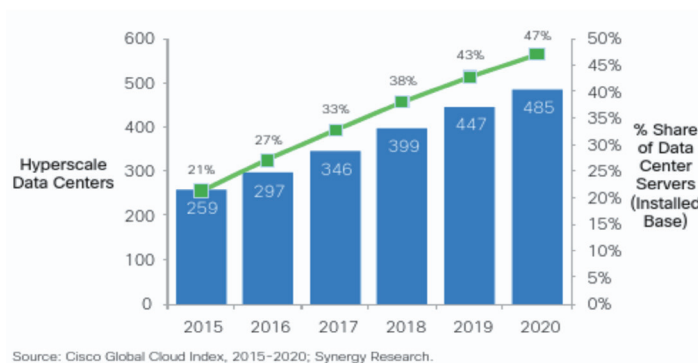
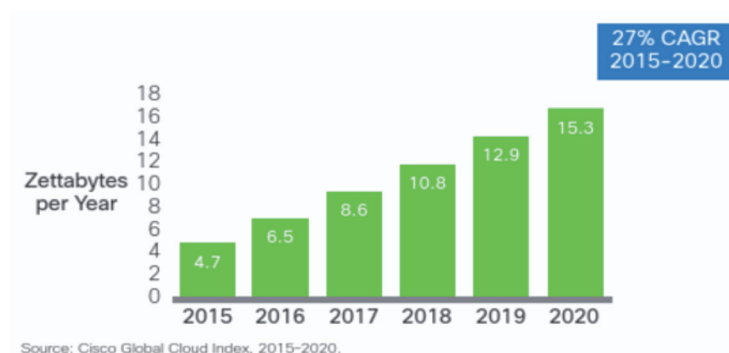


Fig. 1 Increase of IP Traffic in Global Data centers and Increase of Data centers

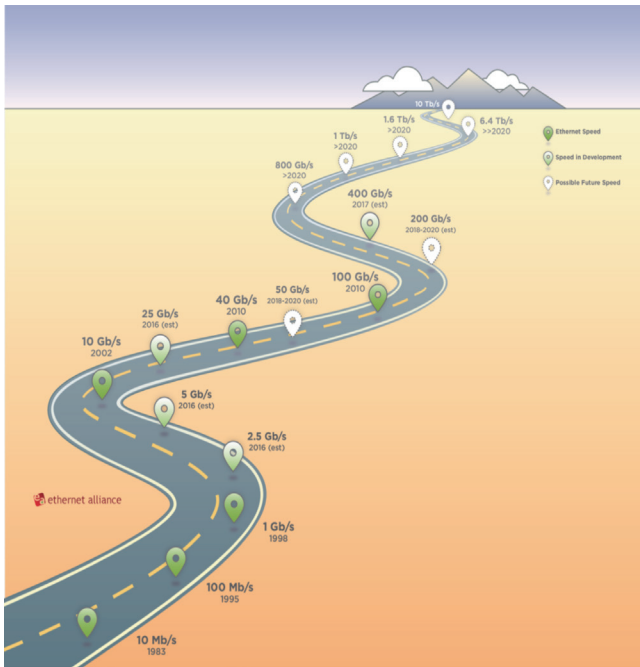


Fig. 2 2016 Ethernet Route

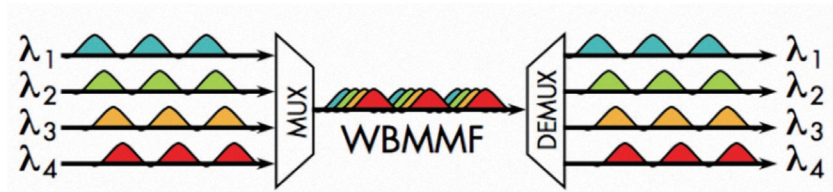


Fig. 3 Shortwave Wavelength Division Multiplexing

Table 1 Demand on Bandwidth of Multimode Fibers in TIA Standard

Fiber	OMB (MHz*km)			EMB (MHz*km)	
	at 850 nm	at 953 nm	at 1300 nm	at 850 nm	at 953 nm
OM3	1500	-	500	2000	-
OM4	3500	-	500	4700	-
OM5	3500	1850	500	4700	2470

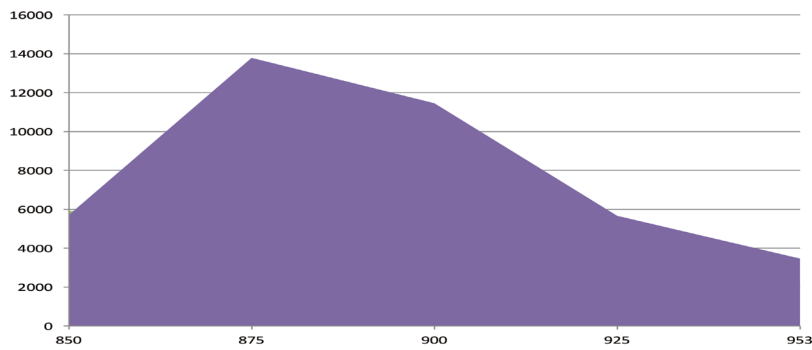


Fig. 5 OM5 Standard (TIA) and Effective Modal Bandwidth of OM4 and OM5 Fiber



Fig. 4 SWDM Alliance

that the multimode fibres remain the preferred cost-effective cabling medium of data centers.

In the meantime, IEEE is developing 100Gbps and 200Gbps Ethernet standard at present which will mainly be used in network backbone of data centers; 400G will mainly be used in network center room of operators and it is predicated that the standard for 400G Ethernet will be issued in 2017. Wide band multimode fibre (WBMMF) supporting 850nm-950nm shortwave wavelength division multiplexing (SWDM) is an excellent solution to realize 100G network transmission of data center; at the same time, it also provides an allowance for the appearance of possible higher rate Ethernet (200G or even 400G). 2016 Ethernet route is as shown in Fig. 2.

Alliance of SWDM Technique and SWDM

● SWDM technique

Shortwave wavelength division multiplexing (as shown in Fig. 3) is a technique adopting single mode fibre wavelength division multiplexing (WDM) technique as reference to extend wavelength range used during transmission from 850nm of traditional multimode



Fig. 6 SWDM MSA

Table 2 Transmission Distance of Wide Band Multimode Fiber

Types of multimode fibres	40G transmission distance (m)	100G transmission distance (m)
OM3	240	75
OM4	350	100
OM5	440	150

Table 3 40G SWDM4 Link Indexes

Main Parameters		OM3	OM4	OM5
Transmission Distance (m)		240	350	440
Insertion Loss (dB)		2.4	2.8	2.9
Path Penalty (dB)	L0:850 nm	2.4	2.8	2.9
	L1:880 nm	2.3	2.6	2.7
	L2:910 nm	2.2	2.5	2.6
	L3:940 nm	2.1	2.5	2.5

fiber to 850nm-950nm. Use highly cost-effective short wave vertical-cavity surface-emitting lasers (VCSEL) source and optimized wide band multimode fiber (WBMMF) to support the transmission of data in four different wave lengths on one multimode fiber and reduce the number of necessary fiber cores to 1/4 of the original and, at the same time, improve the Effective Modal Bandwidth (EMB) of optical fiber and extend the transmission distance.

When the wavelength is longer than 850nm, the dispersive bandwidth of multimode fiber and the transmission distance will be increased. Operating wavelength adopted for the use of SWDM

technique starts from 850 nm and one wavelength will be added for each 30nm, i.e. 880nm, 910nm and 940nm. Therefore, the operating wavelength of wide band multimode fiber is within 850nm-950nm. In shortwave wavelength division multiplexing module, 4 VCSELs produce optical signals in 4 different wavelengths to be multiplexed to a single link and all VCSELs and optical coupling will be realized in optical modules. At the receiving end of module, the signal will be demultiplexed and transformed to parallel electrical signals. Adopt two parallel fibres to realize receiving-transmitting data transmission.

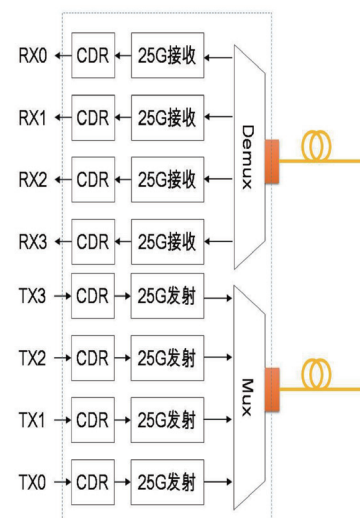


Fig. 7 Block Diagram of 100G Optical Module

● SWDM alliance (as shown in Fig. 4)

As a new technique that can boost the transmission capacity of multimode fibre and increase transmission distance, the significance of SWDM to the construction of data center and to relevant manufacturers of fibres, devices and equipment is self-evident. In 2015, nine companies including CommScope, Corning, Dell, Finisar, H3C, Huawei, Juniper, Lumentum and OFS established SWDM alliance and, thereafter, many manufacturers home and abroad has joined this alliance. At present, the members of this alliance include several fibre and cabling manufacturers such as YOFC, Corning, OFS, Prysmian and CommScop, several equipment manufacturers such as Dell, Huawei, H3C and Juniper and several module manufacturers such as Finisar and Lumentum.

This alliance devotes itself to advance the development and promotion of SWDM technique and promote the application of SWDM optical module in wide band multimode fiber (WBMMF).

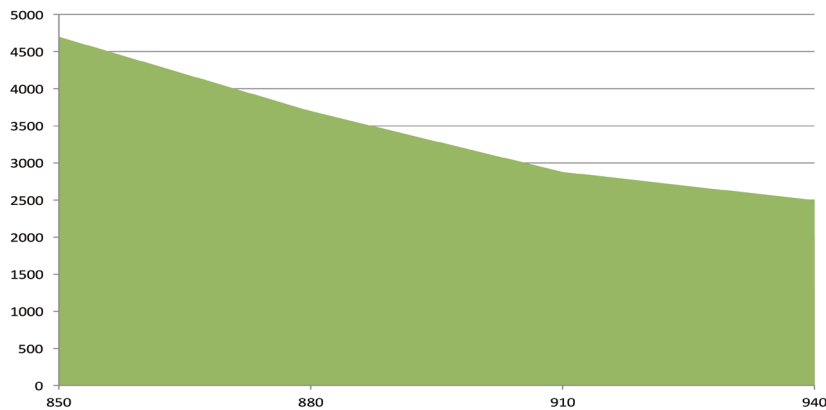


Fig. 8 Effective Modal Bandwidth Demand of OM3, OM4 and OM5 in 40G SWDM4



SWDM alliance says that they will pay attention to the application demand of 40Gbps 4*10Gbps and 100Gbps 4*25Gbps and further extend to the application of 400Gbps in the future. This alliance also says that they will not participate in the formulation of standard or intend to establish optical module MSA. This organization will avoid problems including market segmentation, pricing and competition.

Wide Band Multimode Fibre

The effective modal bandwidth (EMB) of OM3 fibre is 2,000MHz*Km and that of OM4 fibre is 4,700MHz*Km. With the appearance of 100G, 200G and 400G Ethernet, the number of cores and the distance of traditional multimode fibre become the bottleneck impeding the future development of Ethernet. The appearance of wide band multimode fibre breaks the technical bottleneck of traditional multimode fibre and it is the key to realize SWDM technique. Wide band multimode fibre supports 850nm-950nm and it can be used to transmit 4 wavelengths on one multimode fibre. Therefore, it can increase the transmission rate, reduce fibre cores and extend

transmission distance. At the same time, wide band multimode fibre is compatible with traditional OM3 and OM4 multimode fibres and can provide excellent performance as OM4 in traditional application.

Wide band multimode fibre is called OM5 in TIA standard and A1a.4 in IEC standard. It is predicated that the formal IEC standard will be issued in the second half of this year. In TIA-492AAAE-2016 standard issued in 2016, comparing with OM4 multimode fibre, requirements for 953nm over-filled launch bandwidth (OMB) and effective modal bandwidth (EMB) are added for OM5 fibre, as shown in Table 1. The source of over-filled

launch bandwidth is LED and that of effective modal bandwidth is VCSEL. The unit is MHz*km, i.e. the product of bandwidth and distance. It can be simply considered as the lower the signal transmission rate is, the longer the transmission distance will be, vice versa.

Comparing with OM4, the demand on bandwidth of OM5 fibre in long wavelength range is higher, so as to meet the requirements of SWDM technique. Specific parameters of OM5 fibre produced by YOFC is as shown in Fig. 5. Comparing with TIA standard and characteristic curve of OM4 fibre, the effective modal bandwidth of OM5 fibre is far higher than the standard.

Table 4 100G SWDM4 Link Indexes

Path Penalty (dB)		OM3	OM4	OM5
Transmission Distance (m)		75	100	150
Insertion Loss (dB)	1.8	1.9	2	
Path Penalty (dB)	L0:850 nm	1.8	1.9	2.0
	L1:880 nm	1.8	1.9	1.9
	L2:910 nm	1.8	1.8	1.9
	L3:940 nm	1.7	1.8	1.9



SWDM MSA

SWDM Multisource Agreement (MSA) is an industrial alliance to define the optical parameters of SWDM optical transceiver and promote its application. Its members include the following six companies as shown in Fig. 6.

● Transmission rate

In March this year, 100G Shortwave Wavelength Division Multiplexing Multisource Agreement (SWDM MSA) Group issued two (40G and 100G) SWDM standards for the first time. MSA defined the 4x10 Gbps and 4x25 Gbps SWDM optical interfaces used for 100Gbit/s optical transceiver of Ethernet. For 40G, the length of multimode fibre between two transceivers is from 2m to 440m and the unidirectional signal rate of each channel is 10.3125 Gbps. In 100G standard, to guarantee the reliability of system, forward error correction module shall be added. The length of multimode fibre between two transceivers is from 2m to 150m. The unidirectional signal rate of each channel is 25.78125 Gbps.

● Transmission distance

For OM3, OM4 and OM5 multimode fibre, the minimum working range is 2m when it is 40G

and the maximum transmission distances are 240m, 350m and 440m respectively. When it is 100G, the minimum working range is 2m and the maximum transmission distances of OM3, OM4 and OM5 multimode fibre are 75m, 100m and 150m respectively, as shown in Table 2.

Table 2 Transmission Distance of Wide Band Multimode Fibre

● Block Diagram of Optical Module

SWDM4 modules include the following parts: four optical transmitters of different wavelengths, four optical receivers with signal detector, wavelength division multiplexer and demultiplexer and multimode fibre duplex optical

connector. Block diagram of 100G optical module is as shown in Fig. 7.

● Link Index

Link indexes in wavelength division multiplexing multisource agreement of 40G short wave (850~940nm) are given in Table 3.

The standard issued by SWDM MSA Group is slightly different to TIA multimode fibre standard and the effective modal bandwidth demand of 40G SWDM4 is as shown in Fig. 8.

Link indexes in wavelength division multiplexing multisource agreement of 100G short wave (850~940nm) are given in Table 4.

Effective Modal Bandwidth Demand of 100G SWDM4 is as shown in Fig. 9.

Conclusion

Shortwave wavelength division multiplexing (SWDM) technique and wide band multimode fibre (WBMMF) can realize higher transmission rate, longer transmission distance, less fibre cores and low cabling cost. For the construction of the next generation of data centers, SWDM and WBMMF remain the mainstream transmission medium of 40/100 Ethernet of data centers. By further combining shortwave wavelength division multiplexing and parallel transmission technique, it only needs 8-core wide band multimode fibre to support higher-speed application, for example, 200/400G Ethernet.

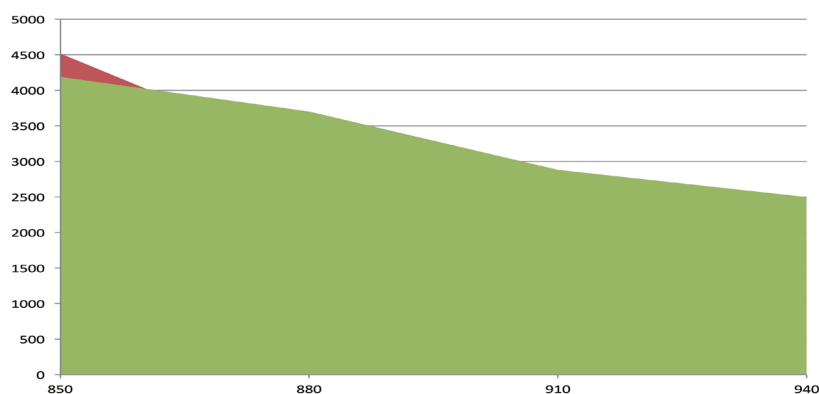


Fig. 9 Effective Modal Bandwidth Demand of OM3, OM4 and OM5 in 100G SWDM4



严格管控抓培训 多管齐下增效益

□ 长飞光纤印尼公司 张振众

2016年8月，长飞光纤印尼公司成功实现了提前投产。投产后，公司生产部成为了产品交付的主角，生产部的主要任务是提高光纤质量、提高制造效率、降低光纤制造成本，以提升企业效益。

长飞光纤印尼公司是印尼乃至东

盟地区第一家光纤企业，当地缺乏制造光纤的各种资源，绝大部分的设备和材料都需要进口，当地也没有光纤制造的技术力量，投产之初确实面临着相当大的难度。犹记得在2016年9月8日（公司投产典礼当日），公司执行

董事兼总裁庄丹对我们叮嘱道，长飞光纤印尼公司虽然已经投产，但是接下来还有很多工作需要开展！我们需要把自己所掌握的技能亲手传授给印尼当地的工人，也需要对当地员工进行系统培训，让他们能够独立自主地工作。为了使公司的印尼员工能尽快掌握生产技术，我们对他们开展了以下三大方面的培训。

精细管理，树立成本意识

为了有效控制与降低生产成本，最大限度提高原材料的利用率，必须首先让所有工程师了解原材料利用率RMC (Raw Material Coefficient)，即每生产一公里光纤需要消耗多少原材料。通过了解这些基本常识，工程师也就有了降低成本的方向。比如，我们可以充分利用光纤涂料容器中的涂料，减少浪费。截止到今年3月，公司节省涂料约265kg，虽然这个数字可能不算多，但是充分利用了资源，节省了成本。严格控制材料使用，加强对员工节能意识的宣传教育，使大家都做到物尽其用，避免铺张浪费，积少成多、聚沙成塔，久而久之也将节省出一笔可观的费用。

提高工艺控制水平，加强员工技能培训

针对工艺人员工艺控制水平整体不高的情况，我们制定了详细的培训计划：每周2~3次理论培训；每天早会后，针对常见问题对工艺人员进行讲解；培训内容具体到每天、每个班级，确保所有倒班工艺及白班工艺都能得到很好的培训。通过一系列培训，工程师的工艺控制水平有了显著提高。

为了规范操作、完善流程、减少报废，针对接管、拉丝、筛选、测试、氩气处理及包装工序，我们制定了详细的操作标准。长飞公司总部派驻的培训师根据操作细则，对所有工序的操作人员进行了一次全方位的考试和评估，记录每个操作人员的问题

并打分，最后汇总各个工序存在的问题，作为以后培训的方向。与此同时，长飞派驻的培训师每天早中班通过“一点课”(One Point Lesson)示范，现场操作培训和指导，讲解程序文件，介绍流程，使长飞光纤印尼公司的操作员养成良好的操作习惯，并能够独立操作、独立处理问题。通过技能培训，员工技术熟练水平和劳动效率均得到了显著提高，也推动着各个班级整体生产能力的提升，提高产品合格率。

加强设备维修保养，提高工程师业务水平

对于工艺设备，我们建立了拉丝塔、筛选机维修保养制度，制定科学保养周期。公司总部设备人员带领长飞光纤印尼公司机电工程师及技术员完成对所有拉丝塔、筛选机的保养。另外，对于设备检修，公司总部设备人员手把手地将维修技能传授给印尼当地工程师，把一些非常复杂的检修过程，分步骤、分部件进行分解，让当地工程师能够充分理解；对于一些更换的部件，则寻找当地资源进行修复，再重新继续使用。对设备进行维修和保养不但使长飞光纤印尼公司的机电工程师、技术员掌握了维修和保养方法，且变废为宝，通过保养延长

了设备使用寿命，提高了可靠性，降低了生产成本。

另外，我们将外围工厂设施设备进行了分类，共十七大系统，如制冷机、冷却塔、废水处理系统等。我们的培训也是围绕这十七大系统进行分类培训，由不同专业的设备工程师分别对各个系统进行理论讲解和现场培训，协助公司机电工程师编订程序文件，制定设备的维修保养计划，设备备件清单整理及备件采购。外围设备的培训将持续进行到今年年底，培训的目的是最终让公司的机电工程师能够独立解决设备问题。

近年来长飞公司陆续在海外投资建厂，海外工厂运营管理的初期总会遇到各种各样的困难，但我们相信办法总比困难多。长飞光纤印尼公司以培训为突破口，通过培训不断提升员工的整体素质，使生产一线员工养成良好的操作习惯，能够独立操作、独立解决问题，减少光纤报废，提高光纤合格率。通过培训也能提高设备人员发现问题、解决问题的能力，提高设备利用率，延长设备使用寿命，提升设备综合利用率。目前长飞光纤印尼公司当地员工的“独立自主”目标正在按照计划落实，光纤制造效率已经超过了预期目标。未来，我们将继续严格管控抓培训，多管齐下，不断提高企业的经济效益。



Strict Control of Quality and More Training to Employees for Gaining More Benefits

□ Zhang Zhenzhong from YOFI

In August 2016, YOFC Optical Fibre Indonesian Co., Ltd. succeeded in putting into operation ahead of schedule. After being put into operation, the Company's Production Department will be a key player of product delivery. The main tasks of the Production Department are to improve the quality of optical fibre, raise the manufacturing efficiency and reduce the manufacturing cost of optical fibre in an effort to make more benefits for the enterprise.

YOFC Optical Fibre Indonesian Co., Ltd. is the first optical fibre producer in Indonesia and even ASEAN countries. Due to the shortage of resources for optical fibre manufacturing in local area, most of equipment and materials need to be imported. No technical force is also available in local area, so, it was really confronted with considerable difficulty at the early stage of operation. We still remember the advice of Zhuang Dan, the Company's executive director & president given to us on September 8, 2016 (the day on which the Company's start-up ceremony was held): YOFC Optical Fibre Indonesian Co., Ltd. has been put into operation, but there are a lot of work to be done next! We need to personally pass the skills we have grasped on to local workers in Indonesia, provide systematic trainings for local employees so that



they can work independently. In order to enable the Indonesian employees to grasp the production technologies as quickly as possible, we have carried out training in three aspects as follows.

Implement elaborate management and establish a cost awareness

To effectively control and reduce the production costs and improve the utilization rate of raw materials to the greatest extent, we must make all the engineers understand raw material utilization rate RMC (Raw Material Coefficient), i.e., consumption of raw materials per km optical fibre produced. By learning about these basic knowledge, the

engineers can find the way to reduce the costs. For instance, we can make full use of the paint in optical fibre paint vessel and reduce the waste. By March this year, the Company has saved the paint consumption by around 265kg. Though the figure is not so much, we have made the most of resource and saved the cost. Keep the material use under strict control, strengthen the dissemination and education on energy-saving awareness to the employees, enable them to make the best use of materials and prevent conspicuous consumption. Many a little make a mickle and the sand accumulates to form a pagoda. A considerable number of expenses will be saved in the long run.

Improve process control level and enhance the staff's skill training

Given the low process control level for process personnel on the whole, we have worked out a detailed training plan: theoretical training for twice to three times a week; answer the FAQs raised by process personnel after morning meeting every day; the training contents are clearly defined to each day and each shift so as to ensure the process personnel of all the shifts to access the training. A series of training classes have resulted in significant improvement of engineers in process control level.

To standardize the operation, improve the process and reduce scrap, we have formulated detailed operating criteria for pipe connecting, wire drawing, screening, testing, deuterium gas treatment and packaging procedure. The trainer dispatched by the head office of YOFC has, according to the operating rules, carried out an all-around exam and assessment to the operators of all the working procedures, noted down the problems of each operator, gave a score to each operator, finally summed up all the problems in existence for various working procedures as a direction of training in the future. Meanwhile, the trainer dispatched by the head office of YOFC also demonstrated and gave on-site operation training and guidance through "One Point Lesson" on morning shift and swing shift by explaining the procedure documents and introducing the operating procedures so as to ensure the operators of YOFC Optical Fibre Indonesian Co. to form good operating habits and enabling them to operate and settle the problems independently. Through the skill training, the employees' technical skill level and working efficiency have been significantly improved and also pushed for the increase of overall production

capacity of various shifts and improvement of product conformity rate.

Strengthen the equipment maintenance and improve the engineers' competence

As to process equipment, we have established a maintenance system for drawing towers and screening machines and defined the periods of scientific maintenance. The equipment personnel from the head office of the Company led the mechanical and electrical engineers and technicians of YOFC Optical Fibre Indonesian Co. to complete the maintenance of all the drawing towers and screening machines. In addition, for equipment's overhaul, the equipment personnel from the head office of the Company passed the repair skill to local engineers of Indonesia by hand, break down the procedures by step and part so as to ensure the local engineers to have a full understanding; for some parts to be replaced, find local resource for repairing them and putting them into recycling. The maintenance and repair to the equipment have not only enabled the mechanical and electrical engineers and technicians of YOFC Optical Fibre Indonesian Co. to grasp the maintenance and repair methods, recycle the waste parts, extend the service life of the equipment, improve the reliability and reduce the production cost.

Moreover, we have also classified the peripheral facilities and devices of the plant, which were divided into 17 systems, involving refrigerating machine, cooling tower and waste water treatment system etc. We have also carried out a classified training centering around the aforesaid 17 systems, gave theoretical lectures and on-site training to various systems by equipment engineers of different specialties, assisted the

Company's mechanical and electrical engineers in compiling procedure documents, making plans for equipment maintenance and repair, sorting out list of equipment's spare parts and purchasing the spare parts. The training for peripheral devices will be provided till the end of this year. The purpose of the training is to enable the mechanical and electrical engineers of the Company to solve the problems of the equipment all by themselves.

In recent years, YOFC has successively invested and built plants in other countries. At the initial stage of operation and management for the plants abroad will inevitably encounter all sorts of difficulties, however, we believe that measures are always more than difficulties. YOFC Optical Fibre Indonesian Co., Ltd. has taken training as a breakthrough, tried to improve the overall quality of the employees through training, make the front-line production employees form good operating habits, enable them to operate independently and solve the problems by themselves, reduce the scrapping of optical fibre and improve the optical fibre conformity rate. The training has also enhanced the equipment personnel's capacity in finding and solving problems, improved the equipment's utilization rate, extending the equipment's service life and escalating the equipment's rate of comprehensive utilization. At present, for local employees of YOFC Optical Fibre Indonesian Co., Ltd., their "independent operation" target is being fulfilled according to the plan. The optical fibre manufacturing efficiency has exceeded the expected goal. In the coming days, we will continue our efforts in strict control and training, take multi-pronged measures in a bid to achieve an increasingly higher economic benefit.

绿色和谐，你我同行

□ 制造中心 程恒

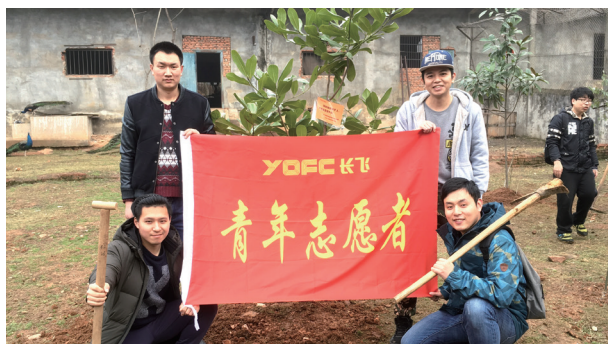


阳春三月万物苏，植树播绿正当时！在全国第39个植树节到来之际，为增强长飞青年的植树造林、绿化环境、美化生活的意识，倡导大家养成低碳环保生活的理念，长飞公司团委组织团员青年开展了义务植树活动，以实际行动践行长飞公司的社会责任，保护生态环境。

植树活动开始前，大家听园艺师傅们介绍了植树的方法及安全注意事项，分享了各自对植树活动的理解，畅谈植树造林的意义及自己为祖国绿化事业做贡献的责任和义务。在植树现场，大家拿起铁锹、锄头埋头植树，各组人员互相配合，有的挥锹铲土、有的扶树填土、有的培土浇水，忙得不亦乐乎。经过一个多小时的劳动，一棵棵玉兰在山坡上“安家落户”，构成了一道靓丽的风景线。大家纷纷肩扛工具和自己亲手栽种的树苗合影留念。

汗流浹背的我们，看着亲手种下的一棵棵树苗在春风中摇曳，坚信它们在经历风霜雪雨后终将枝繁叶茂，所有人心里充满了说不出的喜悦，脸上都洋溢着甜蜜的微笑。这摇曳的绿植这不仅仅是对我们劳动的肯定，更让我们理解了活动的意义。

此次义务植树活动，提高了广大青年员工植树造林，绿化



环境，人人有责的环保意识。同时，也促进了青年员工之间的沟通交流，增进了感情，使大家放松身心，以更好的精神状态投入到未来的工作中。植树造林，功在当代，利在千秋。在国家大力倡导低碳生活、绿色环保的今天，组织此次植树活动充分体现了长飞公司注重环保的社会责任，并有效地付诸于实践。

多年来，长飞公司通过积极展开各项社会公益活动活动，用履行企业社会责任行为的感召力来影响我们的员工、供应商、客户及所有权益人，积极做有社会责任感的企业公民。

Let Us Work Together for Green Harmony

□ Cheng Heng from Manufacturing Center



happiness with sweet smiles on our faces. The swaying trees not only recognized our labor, but also let us understand the meaning of the activity.

The voluntary forestation activity improved young

employees' awareness of afforestation. It is everyone's duty to protect the environment. Meanwhile, young employees enhanced communication with each other. Everyone felt relaxed both physically and mentally. We can went back to work with better spirit. Afforestation is in the interests of current and future generations. Now, the state government energetically advocates low-carbon life and environmental protection. The tree planting activity fully embodied YOFC's social responsibility in environmental protection, and its fulfillment of its commitment.

gardening masters, shared his or her understanding about the tree planting activity, talked about the meaning of afforestation, and his or her responsibilities of making contribution to the greening of the country. On the site of the tree planting activity, everyone bent on planning trees with a spade. Different teams coordinated with each other. Some excavated dirt; some held trees straight and shoveled dirt into the well; some earthed up and watered trees. Everyone was quite busy. After over one hour's labor, many yulan magnolia trees settled down on the hillside, and became a beautiful landscape. We took photos with tree saplings that we planted with shades on our shoulders.

Sweat-soaked, we saw tree saplings swaying in the breeze in spring, and believed that they will flourish after enduring wind, frost, snow and rain. We were full of

For many years, YOFC actively carried out various kinds of social public welfare activities. Its fulfillment of corporate social responsibility has influence on its employees, suppliers, customers and all shareholders. It is committed to being a corporate citizen with sense of social responsibility.

Everything comes back to life in March. It is time to plant trees! On the occasion of the 39th National Tree-planting Day, in order to enhance young employees of YOFC' awareness of afforestation to improve environment and beautify the life, and advocate the concept of low-carbon environment-friendly life, the Youth League Committee of YOFC organized league members to carry out a voluntary forestation activity. It is a concrete move to fulfill social responsibility of YOFC and preserve the ecological environment.

Before the tree planting activity, everyone listened to the way of planting trees and safety precautions introduced by

参加武汉市第十三次党代会有感

□ 研发中心 熊壮

2017年1月，我作为党代表参加了武汉市第十三次党代会，这次参会让我有了第一时间聆听湖北省委书记、武汉市委书记陈一新的报告并与其他党代表一起学习交流的机会。

大会听取并审议了陈书记代表中国共产党武汉市第十二届委员会所作的报告，并审议了中国共产党武汉市第十二届纪律检查委员会的工作报告；随后，选举产生了中国共产党武汉市第十三届委员会和中国共产党武汉市第十三届纪律检查委员会。这次高效、成功的大会，为武汉市今后5年的发展指明了方向，也必将在其发展历史上留下浓墨重彩的一笔。

在党代会上，陈书记的报告给我留下了非常深刻的印象。这个报告高屋建瓴、内容丰富、与时俱进，既有鲜明的时代气息，又极具武汉特色，凸显了中国梦在武汉的生动体现，也反映了几代武汉人对城市发展的期盼，充满了正能量。

陈书记的报告回顾了过去五年武汉市所取得的显著成绩：经济总量突破万亿大关，年均增长9.5%；城市建设有了历史性的发展，机场和地铁

建设如火如荼，“八桥一隧”贯通长江两岸；美丽生态大武汉建设特色初显，江滩公园、东湖绿道建设大规模推进；社会治理模式不断创新，已进入全国最安全城市行列。同时陈书记提出了今后5年的奋斗目标：要高水平全面建成小康社会，加快建设现代化、国际化和生态化的大武汉。

报告从7个方面制定了今后5年的主要工作任务，规划了未来5年武汉市加快发展的宏伟蓝图，吹响了全面复兴大武汉的号角。总之，陈书记的报告对武汉市的经济、社会、文化、生态的发展，对老百姓关心的教育、医疗、环境等民生问题，乃至全面推进从严治党等方面都有全面阐述，让我对武汉市未来的发展充满了信心。会议期间，我也特别关注了社交媒体对本次党代会的报道和对相关人员的采访，社会各界包括专家学者、普通市民百姓都对陈书记的这个报告做出了很高的评价。

陈书记在报告中7处提到了东湖高新技术开发区和光谷。作为光谷的龙头企业之一，在武汉市政府和东湖高新技术开发区领导的关怀

支持下，长飞公司近几年也取得了长足的发展。正如报告中所说，武汉正处于最好的发展机遇期，随着“宽带中国”战略和4G网络建设的大规模展开，长飞公司也处在最好的发展机遇期。去年11月初在光谷希尔顿酒店由长飞公司承办的CRU世界光纤光缆大会上，电线电缆世界权威分析机构CRU预测2017年全球光纤总需求量将再创记录，达到4.36亿芯公里，中国国内的需求也将达到2.4亿芯公里。陈书记在报告中也提到要加快布局发展高速宽带和5G网络，更让我们对公司未来的发展充满了信心。

长飞公司执行董事兼总裁庄丹先生在上任之初就提出了要实现“全球第一、行业领袖”的战略目标。长飞公司自1988年成立以来一直在国内光纤光缆行业雄踞榜首，到2016年末公司终于全面实现了光纤预制棒、光纤、光缆三大核心业务的销量全球第一。目前，长飞公司正在以“坐不住的紧迫感、等不起的责任感、慢不得的危机感”努力引领国内光纤光缆企业，赶超业内的国际标杆企业。

长飞公司已取得了初步成绩：成为全球业内唯一一家掌握三大预制棒生产工艺的公司，拥有行业内最长的产业链，拥有国内该行业唯一的光纤光缆制备技术国家重点实验室，2015年成为工信部首批全国智能制造试点示范单位，这也是当时湖北省唯一一家入围企业。去年中央电视台“中国制造2025全国行”系列报道节目组还专门走进长飞公司，对其智能制造项目进行了专题报道。今后长飞公司也会为将武汉打造成为“中国制造2025”试点示范城市而不懈努力。

在国际化方面，长飞公司也迈出了坚实的步伐，目前已经在印尼、缅甸和南非分别建厂，在全球范围内设立了25个海外办事处，还计划每年在海外建立1~2个厂或分公司。去年我作为公司南非Turn-key项目的负责人，亲身经历了该公司从5月份奠基开工到12月份就竣工开业的过程，很多当地人都感慨此前从未见过像长飞Turn-key项目这样如此迅速的建设投产速度。

作为一名技术和研发人员，我对陈书记报告中提到的要加快提升产业创新能力也感触颇深。长飞公司在成立之

初引进了国外先进的PCVD预制棒生产工艺，但公司一直注重研发和创新，走出了一条技术引进-消化吸收-自主创新的发展道路。目前，长飞公司已拥有了世界上最大、最长光纤预制棒（直径达206mm，长度3m）的生产能力，拉丝速度高达3000m/min，大大提高了生产效率、降低了成本。我们在长飞科技园建成了世界上最大的单体光缆生产基地。除此之外，我们还致力于超低衰减光纤、超低衰减大有效面积光纤、气吹微缆解决方案、全干式光缆等技术产品的研发，这些都是可以引领未来光纤通信发展方向的新产品。

在自主知识产权保护方面，2016年长飞申请专利106项，绝大多数为发明专利，还拥有众多国际专利，荣获“国家知识产权示范企业”称号；2016年我们在各类国际期刊和国际会议上发表论文11篇，部分论文被三大检索系统赋予了较高的影响因子。长飞公司还积极参与国际标准的制修订工作，我本人就担任ITU-T SG15组第17课题副报告人、IEC SC86A WG3组光缆标准编辑人。去年公司向ITU-T提交了6篇标准制修

订文稿，主持3项IEC标准的修订工作，2017年还将承办IEC SC86A的工作组会议。正是由于公司对研发和创新的一贯重视，众多产品和技术荣获国家和省级科技进步奖以及中国电子学会电子信息科学技术奖。长飞公司对研发的持续投入也获得了国家的大力支持，2016年长飞公司获得的国家和省市级科研项目经费高达1.45亿元人民币。

此次听了陈书记的报告，我倍感鼓舞，在今后的工作中我将努力践行报告的精神。借着此次党代会的春风，在武汉市新一届领导班子的带领下，我相信长飞公司也将进一步加大研发创新力度，加快企业转型升级步伐，加快各类国际化人才的培养，把长飞公司打造成国际光纤光缆领域的行业领袖，为武汉市和东湖高新开发区的发展做出自己的贡献。

虽然武汉市第十三次党代会已闭幕，但党代会的精神将激励着各行各业的从业人员在今后的本职工作中锐意进取，聚力改革创新，奋力拼搏赶超，为把武汉市建设成为现代化、国际化、生态化的大都市而努力奋斗！

My Feeling after Attending the 13th Party Congress of Wuhan City

□ Xiong Zhuang from R&D Center

In January 2017, I attended the 13th party congress of Wuhan City as a party representative. The congress offered me an opportunity to listen to reports made by vice secretary of the provincial party committee of Hubei Province and secretary of the municipal party committee of Wuhan City Chen Yixin, and to communicate with and learn from other party representatives.

The report made by Secretary Chen, on behalf of the 12th party committee of Wuhan City, was deliberated and approved at the meeting. The work report of the 12th discipline inspection committee of Wuhan City also was deliberated and approved. Then, the 13th party committee of Wuhan City and the 13th discipline inspection committee of Wuhan City were elected at the meeting. This effective and successful meeting pointed out the direction for the development of Wuhan City in the

next five years. It is bound to leave a significant chapter in the development history of Wuhan City.

At the party congress, the report made by Secretary Chen impressed me deeply. Based on thorough understanding of the current situation, this informative report keeps pace with the times, reflects the flavor of the times and has distinctive characters of Wuhan City. It highlights the Chinese Dream being embodied in Wuhan, and shows Wuhan citizens' hope toward the City. It is full of positive energy.

The report made by Secretary Chen reviewed significant achievements made by Wuhan City in the past five years. Its GDP eclipsed the \$1,000bn mark, representing an average annual growth of 9.5%. It made historical development in urban construction. The construction of the airport and railways is in full swing. "Eight bridges and one channel" connect both banks of the Changjiang River. The characteristic of beautiful ecological environment of Wuhan has taken shape. The big scale construction of the River Park and East Lake Greenway is under way. With constant innovation being made

in social governance model, Wuhan has become one of the safest cities in China. Meanwhile, Secretary Chen brought up the fighting target for the next five years: Building a moderately prosperous society in all respects with high standards, and speeding up the construction of a modern, international and environment-friendly Wuhan.

The report formulated the main task in the next five years in seven aspects, made a grand plan for the rapid development of Wuhan City in the next five years, and sounded the clarion call to revive Big Wuhan across the board. In short, the report made by Secretary Chen explained in details economic, social, cultural and ecological development of Wuhan City, people's livelihood problems that people concern such as education, medical treatment and environment, as well as pushing forward managing and governing the party in strict way, giving me full of confidence in the future development of Wuhan City. During the meeting, I paid special attention to the media's reports about the party congress and interviews with relevant personnel and found that people from all walks of life, including

experts and scholars, and ordinary citizens, all highly praised the report made by Secretary Chen.

In his report, Secretary Chen mentioned East Lake High-tech Development Zone and Optics Valley seven times. As one of the leading enterprises of the Optics Valley, under the care and support of Wuhan Municipal Government and East Lake High-tech Development Zone, YOFC achieved great development in recent years. According to the report, Wuhan is embracing the best development opportunities. With implementation of the "Broadband China" strategy and the big scale construction of 4G networks, YOFC is embracing the best development opportunities too. In early November last year, at the CRU World Optical Fibre & Cable Conference, organized by YOFC, at Hilton Wuhan, wire and cable world authoritative analysis organization CRU predicated that in 2017 the total demand on fibres in the world will reach 436 million KMF and the demand on fibres in China will reach 240 million KMF. In his report, Secretary Chen mentioned that efforts should be made to speed up the planning and development of high-speed broadband and 5G networks, which made us more confident in the future development of the company.

Executive director and president of YOFC Dan Zhuang, after taking



office, brought up the strategic goal of "Being the No.1 in the world and an industry leader". Since it was established in 1988, YOFC has been the leader in the optical fibre and cable industry in China. In 2016, the company eventually ranked No.1 in the world in sales volume of optical fibre preforms, optical fibres and optical cables, which are three core businesses of the company. At present, with "Sense of urgency, sense of responsibility, sense of crisis, and intolerance of slow action", YOFC works hard to lead domestic optical fibre and cable enterprises to eclipse international benchmarking enterprises in the industry.

YOFC has made some preliminary achievements. It has become the only company that boasts

the craftsmanship of three major preforms in the world. It boasts the longest industrial chain in the industry, and the only optical fibre and cable manufacturing technology national key laboratory in the industry. In 2015, it became one of the first batch of national intelligent manufacturing demonstration units of the Ministry of Industry and Information Technology, and it is the only enterprise in Hubei Province that is among the list. Last year, "Made in China 2025 Strategy National Survey" program group of CCTV visited YOFC and made a special

report on its intelligent manufacturing projects. In the future, YOFC will make unremitting efforts to turn Wuhan into an experimental city of "Made in China 2025 Strategy".

In respect of internationalization, YOFC has taken concrete actions. Now, it has established factories in Indonesia, Myanmar and South Africa. It has established 25 overseas offices worldwide, and plans to establish one or two factories or branches every year in foreign countries. Last year, as person in charge of a Turn-key project of the company in South Africa, I witnessed the process from the beginning of the construction in May to the completion of the construction and commencement of operation of the project in December. Many local people said that they have never seen a Turn-key project whose construction was completed in such a speed.

As a technical and R&D personnel, I have strong feelings about speeding up the innovation ability of the industry, as mentioned in the report made by Secretary Chen. At the beginning of its establishment, YOFC introduced advanced PCVD preform manufacturing process from foreign countries. However, the company has always focused on R&D and innovation. It has embarked on a development path of technology introduction-digestion and absorption-self-innovation. Now, YOFC boasts the capacity of producing the biggest and longest optical fibre preform (with a diameter of 206mm

and a length of 3m) in the world. The speed of wiredrawing is up to 3000m/min, which significantly improved production efficiency and lowered the cost. We established the biggest single cable production base in the world in the YOFC Technology Park. In addition, we are also committed to the R&D of technologies and products such as ultra-low attenuation optical fibre, ultra-low attenuation large effective area optical fibre, air blowing micro fibre solutions, and fully dry optical cable. These are new products that may lead optical fibre communication development in the future.

In respect of protection for proprietary intellectual property rights, in 2016, YOFC applied for 106 patents. Most of them were invention patents. It also boasts many international patents and won the title of "National Intellectual Property Demonstration Enterprise". In 2016, we published 11 essays in various kinds of international journals and international meetings. Some essays won high impact factors granted by three major search systems. YOFC also actively participates in the formulation of international standards. I was vice reporter of No. 17 subject of ITU-T SG15 unit, and editor of standards for IEC SC86A WG3 unit optical cables. Last year, the company submitted 6 standard system revision drafts to ITU-T, and presided over revision work of 3 IEC standards, and organized IEC SC86A work meeting in 2017. Thanks to the efforts made by the company on

R&D and innovation, many products and technologies won national and provincial science progress rewards and Electronic Information High-tech Industrial Awards of Chinese Institute of Electronics. YOFC's continuous investment in R&D won great support from the state government. In 2016, YOFC obtained scientific research project funds at national, provincial and municipal level amounting to 145 million yuan.

After hearing the report made by Secretary Chen, I was greatly encouraged. In the future, I will work hard to implement the spirit of the report. I believe that leveraging on the opportunity of the party congress, under the leadership of the new session of the management team of Wuhan Municipal Government, YOFC will further intensify R&D and innovation, speed up the transformation and upgrading of enterprises, speed up the cultivation of various kinds of international talents, turn YOFC into an industrial leader in the international optical fibre and cable industry, and make its own contribution to the development of Wuhan City and East Lake High-tech Development Zone.

Though the 13th party congress of Wuhan City has concluded, the spirit of the party congress will encourage people from all walks of life to forge ahead with determination, focus on reform and innovation, exert themselves to the fullest, and work hard to turn Wuhan City into a modern, international and environment-friendly metropolis.

病魔无情，人间有爱

——感恩长飞

□ 制造中心 魏青（何瑾平之妻）

我是长飞公司光纤部老员工何瑾平的家属，首先我代表何瑾平及我们全家对公司各位领导和各位同事表达最诚挚的谢意和最真挚的感激之情！衷心感谢你们的慷慨解囊和无私帮助。

何瑾平自从2016年5月查出肝细胞癌，到目前为止，前后经历了手术、复发、靶向药治疗、化疗治疗等过程，他本人以及我们全家都饱受病魔带给我们的伤害和巨额治疗费用的负担，在前后3次的治疗中所花费的医药费已高达几十万元，对于我们这样的普通职工家庭而言，已经不堪重负。

幸运的是，公司领导们和同事们得知何瑾平的病情后，立即伸出了援助之手，发起了募捐活动。爱心募捐让我们全家

十分感动，在我们危难的时候，是长飞的领导们和兄弟姐妹们为何瑾平战胜病魔提供了有力的支持和帮助，让我们家感受到了长飞大家庭的温暖。大家的关爱给了何瑾平战胜病魔的信心，更让我们全家看到了希望。我们相信，有这么多爱的托付和期望支持着他，他的身体一定能够康复，在众志成城的爱心面前他一定能够战胜病魔。

病魔无情人间有爱，金钱有价爱心无价，感谢公司的领导和同事们，在此，我代表我们全家对你们的帮助致以最真挚的感谢！



For the Love and Support in Combating the Ruthless

——Thank You, YOFC

□ Manufacturing Center Wei Qing (Wife of He Jinping)

As the family of He Jinping, the veteran employee of the department of optical fibre, YOFC. First of all, on behalf of He Jinping and his family, please allow me to express our most sincere gratitude and appreciation to the leaders and colleagues of the company. Thank you so much for your generosity and help.

He Jinping was diagnosed with liver cancer in May, 2016. He has gone through operations, relapses, targeted drug therapy, chemotherapy and other treatments by now, and the suffering and pain not only made our family heartbreaking, but also caused the harrowingly huge financial burden on us. After the three treatments, the medical bills has piled to tens of thousands yuan, making this vulnerable working-class family cracking and faltering in the face of this disaster.

Fortunately, however, the leaders and colleagues

of the company rendered their help after they knew the bad condition of He Jinping, and raised money for us. This donation is full of love and we appreciate it so much because it was them who were at the back of us and gave us significant support when we were in the face of this misfortune. They renders us the warm and love of the YOFC family without which we would not have had the confidence to fight against the cancer and see hope. We believe He would finally win the battle against the disease with so much love and so many wishes guarding him all together.

While the cancer is ruthless, the love is relentless. While almost everything has a price, the help and support come asking no rewards. From the bottom of my heart, to all leaders and colleagues of the company, thank you, for your generous help, for your priceless support!

潜江情

□ 长飞潜江公司 何点点(何承满之女)

老爸在火车上，
他去潜江，
星月中离开故乡。

春光里，
填沙土，
忙打桩，
尘沙中编织着梦想。

热浪中，
建高墙，
装管廊，
管线弯延美如天上虹。

老爸在汽车上，
他去潜江，
风雨中挥别我和病中的娘。

秋雨里，
筑马路，
架电线，
脚踏实地践行理想。

寒风中，
植草木，
建厂房，
绿草青青装扮着希望。

老爸在路上，
他去潜江，
伴着挚爱亲朋不舍的目光。

一头白发，
一壶老酒，
他把寂寞留在了曹禺故乡。

满脸黑釉，
一身泥沙，
他用智慧和心血建设潜江。

半载光阴悄然流逝，
一座凝聚着现代文明的新厂房
赫然矗立于江汉平原上，
老爸和他的伙伴们
在这片土地上辛勤工作，
他们用心用爱用真诚燃起新希望。
潜江，是他们的第二故乡！

投产的号角已吹响，
“极速之光”闪耀在潜江大地上，
老爸的眼里饱含着泪水，
为他所热爱的长飞，
所自豪的崭新潜江！

My Attachment for Qianjiang

□ YOFC (jiangsu) He Diandian (daughter of He Chengman)

Papa is getting on a train
Qianjiang is his destination
stars and moon were chasing him
away from the deeply-loved home

spring days are not long
sands in and pilings on
wrapped by dusts and glaring beam
papa is busy weaving a dream

heat waves flowing by
buildings rise up high
pipe racks curves lie low
like the sky hanging a rainbow

Papa is getting on a bus
Qianjiang is why he leaves us
winds and rains were his companions
waving bye to ailing wife and his princess

Autumn rains while he builds roads
pattering on his electricity grids
heads down and holding on
papa is chanting his dream song

windy winter is bone-chilling
but construction is not ceasing
seeds in and factories up
the green grass heralding the hope

Papa is travelling on the way
Qianjiang is where he spends his day
love and family in heart
he carries the affection while depart

his hair turned gray
and the spirit mixed with dismay
he left his loneliness light
in the hometown of Cao Yu, the playwright

black glaze on his face
and the mud won't slow his pace
papa devoted all his wit and labor
to construct Qianjiang with full vigor

Oh half a year passes
Behold, on Jiangnan plain the factory rises
civilisation contained in the building
papa and his colleagues are striving
with heart, love and faith
they gave hope more strength
for them, their work is done
Qianjiang became another hometown

the call for production has already begun
the Speed of Light rises on Qianjiang
shedding the tears while excited
papa is proud and delighted
for the YOFC he loves all along
and for the brand-new Qianjiang!

长飞， 我们的青春好朋友

□ 湖北飞菱公司 何宏涛



一自翩然去，弹指数月间。

长飞潜江科技园，在江汉平原拔地而起。

忆往昔，园内杂草丛生，遍地飞絮。

看今朝，厂房建设有序，整装待发。

展未来，长飞引领行业，联接世界。

长飞，我们从四面八方来到你的身旁，

播下我们青春的种子，

洒下我们辛勤的汗水，

收获我们丰盛的果实。

长飞，你见证了我们的成长，

你引领我们扬帆远航！

长飞，我们的青春好朋友！



YOFC, A Good Friend of Our Youth

□ He Hong tao from Hubei Optical Fibre Materials Co., Ltd.

Time has elapsed for months in just like a blink of eyes.

YOFC Qianjiang High-tech Industrial Park has been erected on Jiangnan Plain.

It used to be a place overgrown with weeds and wild plants.

But now, it has become an orderly plant ready for take-off.

In the future, YOFC will lead the industry and connects to the world from here.

We are coming from all directions for you, YOFC.
We have sowed the seeds of youth,

Shed the sweat of hard work,

And finally harvested abundant and fruitful achievements.

YOFC, you are a witness of our growth,

And you lead us to a prosperous future!

YOFC, A Good Friend of Our Youth!

