

Photonic Industry in China

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Abstract: In this paper, we look back the history of the photonic industry in China, introduce the now time situation systemically and predict the developing market in future 5 years.

1. INTRODUCTION

Since the first semiconductor LD was made in 1962 around the world, and the first GaAs LD was made in China in 1963, the first continually working LD in room temperature was made in 1976, the first high-speed Si Avalanche photodecter was made in 1978, the first 1310nm CW semiconductor LD was made in 1980, the first InGaAs photodecter was made in 1982, the first CW room temperature DFB-LD was made in 1988, whether wavelength or device structure, Chinese photonic industry has reached the world level.

In order to develop the Photonic industry, China has constructed three fiber communication bases that are located in Beijing/Tianjin area, Wuhan area, and Shanghai area. China also has constructed some important government-hold integrated optics and photonic lab, Country's opto-electronic technology center and engineering center. According to the schedule of Country's 863 plan, five industry bases were also constructed, which are Beijing, Changchun, Wuhan, Shijiazhuang and ShenZhen. Among them, ShenZhen and Wuhan have become two largest industry bases whether from the product kinds or the characteristics of the product. Their products can be compared with the same products in the world.

Now China has built cable system about 250 to 300 thousand Km, considering other fiber communication system, the total cable system reaches the length of 850 to 900 thousand Km. In these systems, about 200 thousand Chinese photonic devices were used, they strongly supported the construction of the Country.

2. THE BASIC SITUATION OF PHOTONIC INDUSTRY IN CHINA

The photonic industry includes many domains. In this paper, we only introduce the active and passive devices.

Semiconductor photonic devices: This mainly includes optical source and detector. Optical Source includes LD and LED. The wavelength can be 0.85 μ m, 1.31 μ m, or 1.55 μ m, The material and structure can have many type, the rate can reach 2.5Gb/s. Because of the application of MOCVD, Chinese ultra-cell, quantum well devices have reached the first level of the world. In integrated optics area, the PIC of long wavelength DFB-LD + EA, the OEIC of LD/HBT, MSM/HEMT has been realized. For package technology, Besides the traditional dual in line, co-axial structure, transceiver and single fiber two direction assembly and kinds of hybrid integrated structure have been realized..

Optical detector always develops with the optical source at the same time. From Table 1, Chinese opto-eletronic device has reached the same level of the same product of the world. In Table 2, we introduce the mainly manufacture in China. The total sales of the year reach 0.28 billion RMB.

Table 1 The basic situation of photonic device for communication system

	Product	Application	Main supplier
1	High power LED	Low speed, short distance	WTD, Photon, MRV, Beijing Semiconductor Institute(BSI)
2	High speed DFB-LD	High speed, long distance	WTD, Photon, MRV, Beijing Semiconductor Institute, HP, Mitsubishi, Hitachi, Lasertron
3	PINFET	Access network	WTD, Photon, BSI, Laserdiode, Lasertron
4	SDH module	SDH system	Lucent, NEC, Erission, HP, Photon, WTD, OCp
5	CATV device	CATV system	Photon, Lucent, Philips, Oriel, Mitsubishi,
6	Transceiver	Access network, SDH system	Photon, WTD, HP, Lucent, AMP
7	Pump LD	EDFA	WTD,SDL

Table 2 Main supplier of photonic devices in China

	Name	Product	Ability	Total Sales in 1999
1	Photon	Device for PDH, SDH , Access network , and WDM, CATV system	100 thousand pairs/year	More than 0.1 billion RMB
2	WTD	Device for PDH, SDH , Access network , and WDM, CATV system	70 thousand pair/year	0.1 billion RMB
3	BSI	Device for digital system		12 million RMB
4	13 th Institute	Device for digital system		
5	44 th Institute	Device for digital system		

Table 3 Main EDFA supplier in China

	Name	Research	Manufacture	Ability	Total Sales
1	Wuhan Device Institute	Yes	Yes	1500	
2	Photon	Yes	Yes	Several Hundred	110 million
3	KaiFA Technology	Yes	Yes	1500	Several million
4	Tsinghua University	Yes			
5	13 th Institute	Yes			
6	BSI	Yes			
7	8 th Institute	Yes			
8	Electronic Technology University	Yes			
9	NanKai University	Yes			

2.1 Erbium doped fiber amplifier (EDFA). EDFA is an important breakthrough in the nine-five plan in China. The commercialized product has appeared. Now the devices in the EDFA such as isolator, WDM and erbium fiber, Pump LD can all be made in China, but the yield is small. According to the approximately estimation, the total output is 3000 pieces, the total sales is 0.2 billion RMB. Table 3 introduces the basic situation.

2.2 LiNbO₃ based passive devices. From the 1970th times, China has researched phase modulator, M-Z intensity modulator, 2×2, 4×4, 1×8, 1×16 optical switch, kinds of sensor and multi function gyro chip. Because of the high cost and poor reliability, the large-scaled production is not realized. Photon Company now develop a new technology, this maybe make the large-scaled production possible in future. From the approximately estimation, the total sales will reach 20 million RMB.

2.3 Passive devices. Because of the quickly development of the access network construction in China in recent years, especially the fiber CATV network, the passive fiber devices now become an new propitious industry. From the approximately estimation, the total sales of the passive devices will reach the 2 times of the active devices, about 0.5 billion RMB. Up to now, below passive devices have realized large-scaled production: Kinds of optical connector, coupler, power

splitter, attenture, multiplexer, isolator etc. Devices based on fiber grating will be commercialized soon. Table 4 listed the basic researching and producing situation for passive devices in China. From the above 4 domains, Chinese photonic industry (active and passive) can get the total sales of 1 billion RMB.

Table 4 The situation of passive devices

	Organization	Research	Production	Main Product	Annual Sales (million RMB)
1	Wuhan Device Institute	Yes	Yes	All kinds	90
2	23rd institute	Yes	Yes	Fiber devices	100
3	34 th institute	Yes	Yes	Connectors, coupler, attenture	400
4	ShenZhen Zhonghe		Yes	Connector	250
5	Northern optical communication		Yes	Coupler	500
6	ShenZhen Lightwave.		Yes	Connector	40
7	Kaifa Tech		Yes	Isolator	100
8	JiKai Tech		Yes	Connector	
9	Shanghai Laser		Yes	Switch	
10	JiaTai		Yes	Connector, coupler	
11	Tianjin Fiber	Yes	Yes	Connector, splitter	
12	Foshan Optical Communication Co.		Yes	All kinds	
13	Tsinghua University	Yes		Fiber grating	
14	Zhejiang University	Yes		Splitter, waveguide	
15	HuaZhong Polytechnic Univ.	Yes		Fiber grating	
16	Shanghai University	Yes		Filter	
17	Peking Post and Communication Univ.	Yes		Fiber grating	
18	Peking University			OADM	

3. THE PREDICTION OF PHOTONIC INDUSTRY IN CHINA.

3.1 Active device

According to the actual experience of economical construction and communication construction, active and passive device must develop concordantly. Also because of the special situation of communication construction, from the prediction of the experts, Chinese photonic device market will increase by 25%, Up to the year of 2003, Chinese will need about 5million photonic devices. The actual need in 1998 is about 0.5 million, this estimation accords with the result of some survey. Because most of the join-ventured communication equipment manufacture's photonic devices are provided by the foreign manufactures, the need for domestic devices only reach the 25%-30% of the total, about 1.5million pieces. In 1998, the actual sales is about 150 thousand pieces, Among them, Photon and WTD reach the 86%. Since 1998, Fiber access network and LAN, HFC is developing quickly. So up to the year of 2001, Photonic devices 's market increase should be 27% per year. The prediction is listed in table 5. From the actual situation of this year, this prediction is accurate. Assume the average price each device is 1400-1500, the total sales in 1999 should be 0.26-0.28 billion RMB. Although the need for domestic devices is increasing, market share is extending, because of market competition, the increase of producing efficiency, the price is also continuously going down. So the increase of annual total sales is small, also the profit is small.

Table 5 The prediction of optical active devices **unit: 10 thousand**

Year	Total need	Domestic Devices	Note
1999	62.5	18.75	
2000	78	23.4	
2001	97.5	29.7	
2002	121.9	37.7	
2003	152.4	47.9	

3.2 EDFA

EDFA now finds it's chief application in digital communication system and fiber CATV system. In 1999, the domestic EDFA's sale reach 1800 piece, the sales reach 0.2 billion RMB. In digital and analog system, people usually put an EDFA each 50 Km, but in CATV system, people often use it as power splitter, in this situation, we can not simply estimate the number of EDFA from the length of cable. If we put the sales in 1999 as a base, according to the sale increasing and price change, we predict the EDFA market in future 5 years as listed in table 6.

Table 6 The prediction of EDFA

Year	Annual increase	Total sales	Price/each (thousand RMB)	Annual Sales (million RMB)	Note
1999	Base	1800	105	18.9	
2000	25%	2250	95	21.375	
2001	25%	2813	85	23.910	
2002	28%	3601	75	27.008	
2003	30%	4681	65	30.427	
2004	30%	6085	6	36.51	

Here we note if PDFFA for 1310nm use is realized, the fiber amplifier market will be brighter. This is because most cable system is 1310nm system, at that time the fiber amplifier need will increase quickly. We must give this an enough notice.

3.3 Passive device

Passive devices include many kinds of devices, the development of fiber access network, HFC network, fiber LAN make the quickly development of passive devices possible. Now this has become a big industry. If we put the market of 1999 as a base, assume 50% annual increase, table 7 lists the prediction result.

Table 7 The market prediction of passive devices

Year	Sales increase	Annual Increase (m RMB)	Note
1999	Base	50	
2000	50%	75	
2001	50%	112.5	
2002	50%	168.75	
2003	50%	253.125	
2004	40%	354.375	

4. CONCLUSION

Chines photonic industry has made a large contribution to Chinese info highway construction. Up to now, an integrated-scaled photonic industrial has been made. On another side, China also has a large gap with the world. The most important is the chip production, not only the low yield, but also the kinds, we must take some methods to keep up with the world.