The global market is the goal

BrPhotonics invests in research and development to develop advanced optical devices for export

Yuri Vasconcelos

After only a little more than one year in business, BrPhotonics, specializing in research and development of high-speed optical communications systems, recently commemorated closing its first deal with an international client. The company sold an optical modulator, an essential piece of equipment in data transmission networks, to the Tyndall National Institute, in Ireland, one of the principal European centers for research in Information and Communication Technologies (ICT). From a financial standpoint, the sale of a single unit is not significant, but it is loaded with symbolism. BrPhotonics was established with the aim of becoming a major international competitor in the field of optical communications and this first international transaction, to some extent, has opened the doors to the global market.

Located in Campinas, São Paulo State, the company is a joint venture between the Center for Research and Development in Telecommunications (CPqD) and the American group GigOptix, based in San Jose, California. A former Telebras research center, and a private entity located in Campinas since 1998, CPqD owns 51% of the business; partner GigOptix, one of the largest high-speed semiconductor component suppliers in the world, owns the other 49%.

"BrPhotonics was founded in 2014 to be a global leader in photonic and microelectronic devices for high-speed optical communications systems, namely those over 100 gigabits per second (Gbps)," states Júlio César Rodrigues Fernandes de Oliveira, former CPqD manager of optical technologies and current president of BrPhotonics. "The objective of our company is to vertically integrate production with the convergence of photonics and microelectronics, focusing on optical communications applications."

Júlio César Rodrigues Fernandes de Oliveira, first from the left, president of the new company, together with members of the P&D team

LÉO RAMOS CHAVES

According to him, direct and indirect investments (such as patents and equipment) to make the business viable cost more than $30 million and 2015 sales, while the company is still in the startup phase, are estimated at $1.5 million.

The economic segment in which BrPhotonics operates continues to grow. The advance of the Internet, together with cloud computing and the proliferation of smart solutions for mobile phones, tablets and televisions, have had a direct consequence on the increase in information traffic (voice, data, movies and music), which requires the constant expansion of transmission networks. Most of this data travels through fiber optic networks, devices with a diameter similar to that of a strand of hair that transmit information via laser light. In addition to cables, network infrastructure also consists of amplifiers, receivers (photodetectors) and transmitters (lasers and optical modulators), responsible for transforming the electrical Internet signal into an optical signal, converting the information into light signals.

BrPhotonics specializes in supplying the devices inside the optical transmitters and receivers that make up the networks designed to work at transmission speeds of 100 Gbps to 1 terabit per sec-

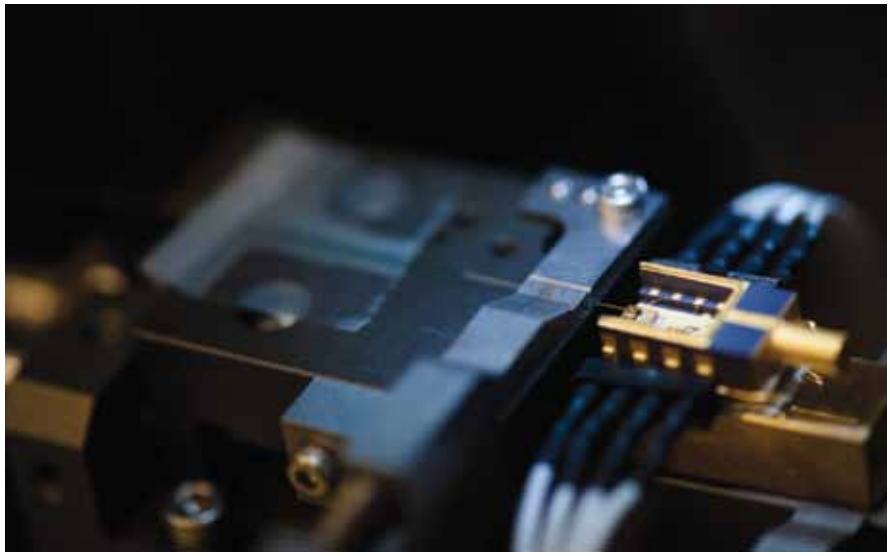
COMPANY

BR PHOTONICS

R&D Center
Campinas, SP

No. of employees
28

Principal products
Devices used in optical transmitters and receivers that make up high-speed transmission networks



Fiber optic alignment (*above*) and close-ups of the company's high-speed optical transmitter, called TOSA

ond (Tbps), which should be reached soon. Today, daily peak Internet traffic in the São Paulo Metropolitan Region is 877 Gbps, according to data from the DotBR Information and Management Center (NIC.br), coordinated by the Brazilian Internet Steering Committee. The company's client is not the Internet end user, but rather telecommunications companies and operators who provide broadband services. "Our advantage is our knowledge of the technology underlying lasers, modulators and receivers, the technology of silicon and polymers, together with our ability to design microelectronic chips," stresses Júlio César.

In order to achieve its goals and make a splash on the international market, BrPhotonics is paying special attention to research and development (R&D) activities. In this initial phase of operation, spending has been more significant — about 60% of the total investment. The company's business plan indicates that investment in P&D will continue over the years, with 25% of gross income earmarked for this purpose. "This is essential for us. It is the heart of the company, whose goal is to compete on the market with innovative products," says Júlio César. In order to do this, BrPhotonics is also investing in trained personnel. Half of all staff members, consisting of 12 employees and 16 contract researchers, have master's or doctoral degrees. The contract personnel provide services through agreements in Brazil, the United States and Italy.

The diverse team is composed of experienced researchers, such as physicist Wilson de Carvalho Júnior, 58, director of micromanufacturing, who had previously worked at the National Synchrotron Light Laboratory (LNLS) and at the Renato Archer Center for Information Technology (CTI), both in Campinas. Others have been in the field for less time, like electrical engineers Alexandre Passos Freitas, 28, and Felipe Lorenzo Della Lucia, 31, both graduates of the University of Campinas (Unicamp), and mechanical engineer Luis Henrique Hecker de Carvalho, 26, a graduate of the Federal University of Campina Grande (UFCG), in Paraíba. All have at least a master's degree, while Felipe and Júlio César have doctorates.

NAMES OF INSTITUTIONS FROM WHICH BRPHOTONICS RESEARCHERS GRADUATED

Júlio César Rodrigues Fernandes de Oliveira, electrical engineer, president of BrPhotonics	Federal University of Campina Grande (UFCG): undergraduate degree University of Campinas (Unicamp): master's and doctoral degrees
Wilson de Carvalho Júnior, physicist, director of micromanufacturing	Federal University of Paraná (UFPR): undergraduate degree Unicamp: master's degree
Felipe Lorenzo Della Lucia, electrical engineer, senior researcher in micromanufacturing	Unicamp: undergraduate, master's and doctoral degrees
Alexandre Passos Freitas, electrical engineer, photonic circuit project manager	Unicamp: undergraduate and master's degrees
Luis Henrique Hecker de Carvalho, electrical engineer, director of advanced systems	UFCG: undergraduate degree Unicamp: master's degree, doctorate (underway)

TECHNOLOGY TRANSFER

One of BrPhotonics's competitive advantages is the fact that it has already mastered optical technologies, despite being a young company. This is because the agreement signed by CPqD and

LPhotonic chip manufacturing laboratory: clean rooms for sophisticated components

GigOptix provided for the transfer of knowledge, intellectual property and technologies already developed by the two partners to the new company. GigOptix moved the assembly line installed in Bothell, Washington, to Brazil and shared its Thin Film Polymer on Silicon (TFPS) technology with BrPhotonics. Similarly, CPqD transferred its Silicon Photonics technology and its experience in optical encapsulation and design and test resources in this field. It also provided space for the company in its technology park, *Pólis de Tecnologia*. According to the agreement, BrPhotonics received 17 GigOptix patents and four from CPqD.

The company's industrial facilities were officially inaugurated in August 2015. The factory houses the entire production chain for the photonic chip, from design to encapsulation and testing. According to Oliveira, only two countries, Germany and Switzerland, manufacture photonic chips of this level. "We believe that, with our factory, Brazil has an opportunity to replace imports and generate employment and income here at home," he says. To produce such sophisticated components, the facilities have laboratories with class 100 clean rooms—which contain no more than 100 particles larger than 0.5 micron (1 micron is a millionth of a meter)—and class 10,000 clean rooms. While the class 10,000 clean rooms house chip packing infrastructure, the class 100 rooms, containing the equipment transferred from GigOptix's US plant, is for manufacturing the photonic chips.

For now, BrPhotonics's main product is the integrated TOSA (transmitter optical sub-assembly) platform. This is a miniaturized, high-speed (100 Gbps) optical transmitter that includes a laser and optical modulator. According to BrPhotonics's president, TOSA was designed to meet the demand of manufactures of transceivers (transmitters and receivers), which are used for long-distance, high-speed transmission applications. "Its price is competitive compared with that of international competitors, who usually charge about $3,500 per unit for large volumes of over 2,000 units," says Oliveira.

In addition to TOSA, two other items have already been developed by the company: an optical modulator and test equipment, named Lab in a Box. The modulator is the component of the transmitter responsible for converting the electrical information signal into a light beam that can be sent via fiber optic cables. The device was built on a polymer substrate using Silicon photonics technology (SiPh) The other product, Lab in a Box, is a measurement device that enables optical transmission and reception, plus digital processing of its signals, in a laboratory environment. "This equipment is unique in Brazil and has only a few global competitors, including Tektronics and Coherent Solutions in the United States," says Luis Carvalho.

The company also has a project through the FAPESP Program to Support Research in Small Business (PIPE), approved in the second half of 2015, and coordinated by Wilson Carvalho, whose objective is to develop a type of laser used in optical transmitters in Brazil. "Today we purchase this laser from external suppliers and integrate it into TOSA. With FAPESP's help, we want to develop our own laser," the researcher says. "That way we will have greater technological control over the device and make TOSA more competitive in the global market. ■

Project

External cavity laser in silicon photonics with ultrabroad tuning range for applications in DWDM systems (No. 2014/21731-6) **Grant Mechanism**: Innovative Research in Small Businesses Program (PIPE); **Principal Investigator**: Wilson de Carvalho Júnior (BrPhotonics); **Investment**: R$144,037.27 and $282,901.75.

PHOTOS LÉO RAMOS CHAVES