Translation

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EpiPhotonics

KOHOKU

NEWS RELEASE

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Kohoku Kogyo Co., Ltd.
1623 Takatsuki, Takatsuki-cho,
Nagahama-shi, Shiga
EpiPhotonics Co., Ltd.
5th floor, KAWAZ Building, 2-1-16
Yamatominami, Yamato-shi, Kanagawa
Prefecture

Development of an Epitaxial PLZT Thin-film Ultra-fast Optical Modulator

- Contributing to the innovation of optical access networks for "Beyond 5G" -

EpiPhotonics Co., Ltd. (headquarters: Yamato City, Kanagawa Prefecture) and its wholly owned subsidiary EpiPhotonics USA, Inc. (headquarters: San Jose, California, U.S.A.) of the Kohoku Kogyo Group have developed a single-crystal like PLZT thin-film ultra-fast optical modulator capable of polarization-independent operation. The modulator will contribute to larger branch size optical access systems and reducing power consumption. Those achievements were obtained partly under the contract with the Ministry of Internal Affairs and Communications' project "Research and development of advanced optical transmission technology for a green society."

[Background]

Optical network infrastructures must transmit enormous amount of data generated everywhere at ultra-low latency, at ultra-high speed and at low power consumption to support the ever-progressing Internet of Things (IoT), cloud computing, high-definition video distribution, mobile systems, and etc. As communication traffics explode with these developments, it is expected to increase output optical power from optical transmitters to expand the number of slit branches, to reduce power consumption, and to save costs by reducing the number of optical fiber amplifiers per the higher transmitted power in optical access systems. Because of those benefits, the optical modulators* that will comprise future optical transmitters capable of accepting more intense laser light in addition to ultra-high speeds will be required.

[Results this time]

The ultra-fast optical modulator developed this time is based on single-crystal like PLZT* thin film technology based on our unique solid-phase epitaxial growth*. By using this PLZT thin film as an optical waveguide, we have already commercialized ultra-fast optical switches capable of nanosecond switching time. By optimizing the materials and processes for the optical modulators, we developed an ultra-fast PLZT optical modulator which can achieve a baud rate* above 100 G (Photo 1).

Because it is possible to obtain an extremely large electro-optical effect* which is nearly 10 times greater than that of conventional materials, ultra-compact, low-voltage, very efficient, and high-speed modulation are possible intense laser light. Moreover, while polycrystalline PLZT thin film formed by a conventional sol-gel method has large optical loss issue due to scattering, the company's single crystal PLZT thin film enables higher transmission efficiency due to the single crystal nature.

Development in various applications is expected for this ultra-fast optical modulator in the future. Using the fact that it enables polarization-independent operation, which is not possible with conventional optical modulators, we are also considering applications in low-cost ROF (Radio On Fiber)* systems, an innovative

technology for optical access networks for “Beyond 5G.” In addition, because PLZT thin film deposition on silicon wafers is also possible, it also has potential for integration with silicon photonics and other devices.

EpiPhotonics will exhibit ultra-fast PLZT optical switches and ultra-fast optical modulators at ECOC2024 to be held in Frankfurt, Germany this coming September.

[Future prospects]

Recent results are expected to lead to the application of PLZT optical modulators to many systems, including optical access systems and data centers so that lower power consumption. The Company has already received inquiries from optical communication system vendors, including from overseas, and is planning early sample shipments for social implementation of this development results.

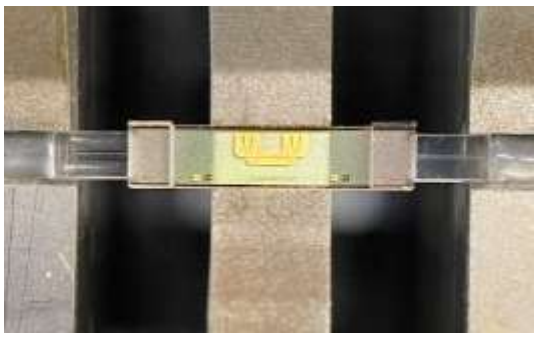

Photo 1. The newly developed PLZT optical modulator chip

* Optical modulator: An optical modulator is a device used in optical communications, etc., which can load information onto a laser beam by modulating the intensity and phase of the light.

* Solid-phase epitaxial growth: A method by which an epitaxial crystal are grown from a substrate surface after an amorphous thin film formation on the substrate rather than a conventional method growing thin film on a wafer in a vacuum.

* PLZT: An oxide of lead (Pb), lanthanum (La), zirconium (Zr) and titanium (Ti) that exhibits extremely high electro-optical effects by control of its composition and crystal orientation, and had been used practically as a nonvolatile memory material using its ferroelectric properties.

* Baud rate: A value that indicates how many times digital data can be modulated and demodulated per second.

* Electro-optical effect: The effect that changes the refractive index by application of a voltage.

* ROF: A system that includes optical fiber transmission in the middle of a wireless service.

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< Overview of Kohoku Kogyo Co., Ltd. >

Kohoku Kogyo Co., Ltd. was founded as a manufacturer of lead terminals for aluminum electrolytic capacitors in 1959, and later expanded into optical components and devices business in 2000. Today, lead terminal business accounts for 55% of sales, and optical components and devices business accounts for 45% of sales. In optical components and devices business, The Company has a 50% share of the market for optical isolators for submarine cables and has become a leading company in this field. In addition, The Company is advancing the commercialization of high-purity quartz glass business using the slurry casting method as a third growth business.

< Overview of EpiPhotonics Co., Ltd. >

EpiPhotonics Co., Ltd. was established in 2007 based on 20 years of research and development on PLZT optical waveguide technology. The company has a track record of research and development in collaboration with the Ministry of Internal Affairs and Communications, the New Energy and Industrial Technology Development Organization (NEDO) and others. EpiPhotonics is advancing the development of various optical device products based on the PLZT technology in fields such as optical communications, optical quantum computers and data centers. The company has started modulator sample shipments to major telecommunications equipment vendors and telecommunications carriers, and is aiming for full-scale commercialization from 2026.

< Inquiries related to this news release>

EpiPhotonics Co., Ltd.

5th floor, KAWAZ Building, 2-1-16 Yamatominami, Yamato-shi, Kanagawa Prefecture, 242-0016, Japan

E-Mail: info@epiphotonics.com

Kohoku Kogyo Co., Ltd., Investor Relations and Public Relations Department

1623 Takatsuki, Takatsuki-cho, Nagahama-shi, Shiga, 529-0241, Japan

TEL: +81-749-85-3211 E-Mail: ir@kohokukogyo.co.jp