

LIGENTEC adds wide tuning range heater modules to its product lineup

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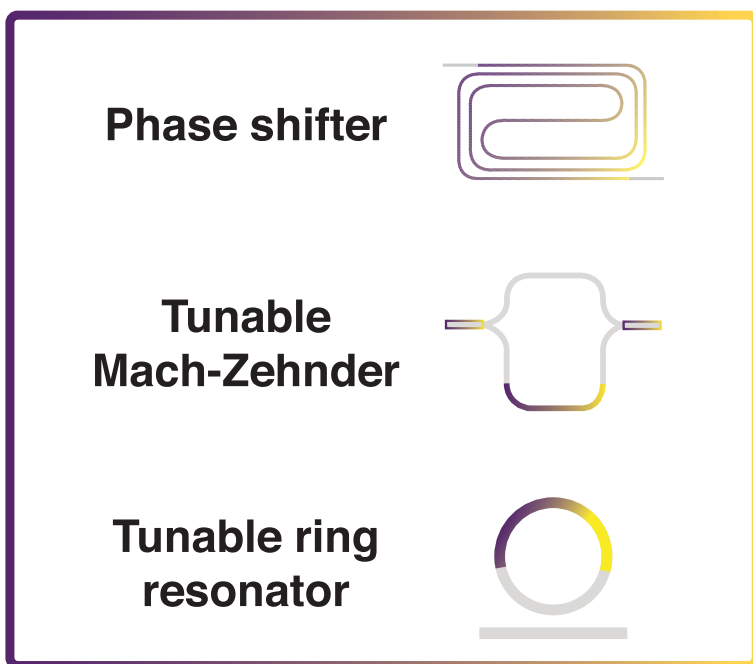
According to the company, LIGENTEC's advanced heater module provides four times more thermo-optical tuning and improved stability for tunable

ring resonators and Mach Zehnder Interferometers (MZI) than standard heaters developed in silicon nitride. Development of the new heater module was customer driven – LIGENTEC indicated their customer needed a large tuning range for a ring resonator that was not available with other heater materials. In their application the material needed to reach a temperature over 300° C to achieve the large tuning range that they needed.

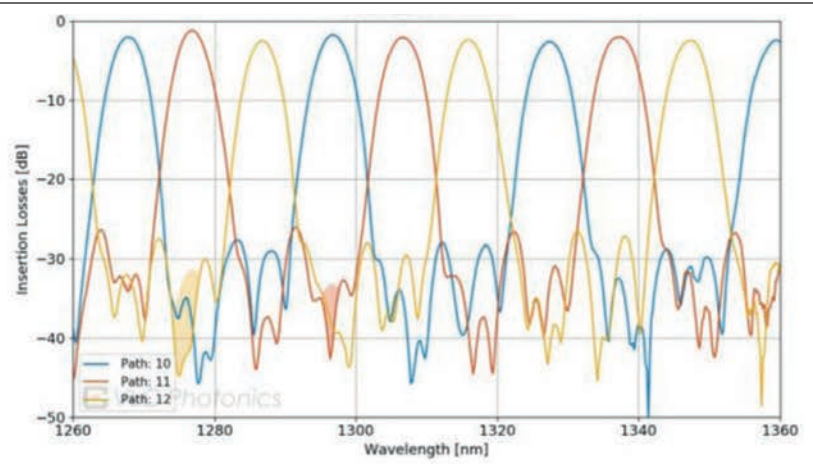
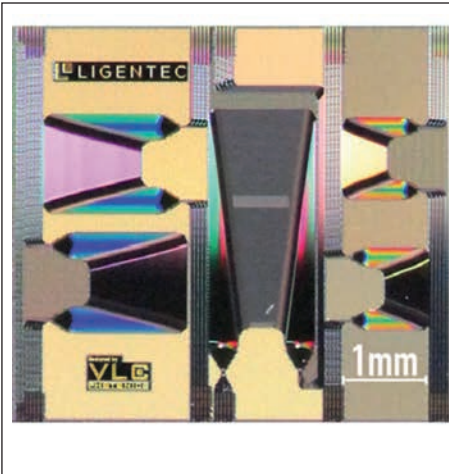
"The new advanced heater module gives access to very high local temperatures and in such a way can heat the silicon nitride waveguide and change its temperature-dependent refractive index. For example, it is used to tune wavelength selective filters by large tuning ranges, MZIs by several pi phase shifts, long delay lines by long phase shifts or ring resonators for frequency comb generation by more than one full free spectral range obtaining more than 4nm of tuning. This is used for telecom and datacom applications as well as spectroscopy and metrology where large tuning ranges are needed," stated Dr. Michael Geiselmann, Managing Director.

The newly available heater module is optimized for LIGENTEC's all-nitride AN800 process with waveguides that offer low bending radii (< 0.005 dB for 10 turns of 50um radius), low coupling losses (< 1 dB/facet), low propagation losses (< 0.1 dB/cm) and high power handling (up to 10 W tested). The company said that the heater material can support very high temperatures.

Compared to aluminum based heater materials, LIGENTEC's product is much more stable at high



Advanced heater module for long range thermal tuning: Sketch of three application cases utilizing the advanced heater module. From left to right: Long phase shifts in optical delay lines; more than 4Pi shifts in MZIs; and large tuning range of ring resonators for filters or for shifting the resonances of a generated optical frequency comb.



temperatures: above 500° C. Furthermore, it is fully compatible with large scale CMOS fabrication lines, which makes scaling to volume easy.

Designed using Lumerical’s DEVICE Suite, the LIGENTEC heater module is responsive and stable over an ultra-broad tuning range. According to the company, a ring resonator with a free spectral range (FSR) of 500 GHz (resonance separation of 4 nm) can be tuned by more than 4 nm operating at telecom wavelength range, thus covering a full tuning of the FSR. Similarly for MZIs, multiple pi-phase shifts are possible.

The company indicated that Lumerical’s simulation tool, DEVICE HEAT, was essential to the design phase of product development since it takes into account the material properties and heat coefficients of silicon nitride and glass, linking these factors directly to the optical mode problem solver within the design software.

Lumerical’s DEVICE Suite performs multiphysics simulation of heat and electrical conduction, combined with photonics simulation, including relevant material models in each physical domain.

TESTED EXEMPLARY PERFORMANCES

Wavelength	O-band	C-band	900 nm
Insertion loss	1 dB	1.5 dB	4 dB
Crosstalk	35 dB	30 dB	35 dB
Channel spacing	4.6 nm 10 nm	6 nm	4 nm 10 nm 20 nm
Shape	Gaussian	Flat-top	Gaussian
FSR	18.4 nm 30 nm	24 nm 48 nm	30 nm 70 nm 140 nm
Chip size	2 x 2 mm	1 x 2 mm	1 x 2 mm

Designed and measured by **VLE PHOTONICS**

It is an ideal platform for designing photonic integrated circuits (PICs) targeted for LIGENTEC’s All-Nitride (AN) process. Due to the significantly low loss characteristic of LIGENTEC’s AN core technology, the fidelity of imported material data is critical to simulation quality. With its HEAT and CHARGE solvers, Lumerical’s DEVICE Suite provides multiphysics simulation capabilities and workflows to model the interaction between optical, electrical and thermal effects at the physical level.

About Ligentec

LIGENTEC specializes in low loss photonic integrated circuits for customers developing products for a wide-range of applications including integrated quantum optics, LiDAR, sensors and microwave photonics. LIGENTEC commercializes all-nitride-core technology; the company received a PIC Award at the PIC International Conference in 2018. Its technology uses thick film optical grade LPCVD deposited silicon nitride and optimized cladding to provide guaranteed performance in propagation loss. Through its all-nitride (AN) technology, LIGENTEC enables customers to develop their products to support Industry 4.0 applications and a wide range of other products where PICs offer advantages such as smaller size, high data rate, wide bandwidth and immunity to EMI. Customers benefit from the fact that LIGENTEC provides a clear path to volume production. The company offers multi project wafer (MPW) foundry options to keep costs low, as well as the ability to serve the needs of company’s requiring dedicated wafer runs – LIGENTEC can deliver small quantities of wafers with high performance, short turnaround times (two months), and devices sufficient for early stage proof of concept development as well as research programmes. Contact LIGENTEC for additional details: www.ligentec.com