Breakthrough Results for 10 Gbps Lasers Attained by Japanese Researchers using NL Nanosemiconductor's Quantum Dot Wafers

Dortmund, 21 Sep 2004 – Breakthrough temperature stability results have been achieved by scientists at Fujitsu and The University of Tokyo from lasers based on quantum dot wafers grown by NL Nanosemiconductor GmbH (Dortmund, Germany), an advanced facility for nano-epitaxy wafers used in semiconductor lasers. The scientists have developed lasers that are capable of maintaining stable optical power output over a wide temperature range at a speed of 10 Gbps. Such devices would enable the creation of optical transceivers which are smaller, cheaper and consume less power than current devices according to Juergen Kurb, CEO of NL Nanosemiconductor.

The laser was developed by a team led by Professor Yasuhiko Arakawa, Director of the Nanoelectronics Collaborative Research Center at The University of Tokyo, and member of the Scientific Advisory Board (SAB) of NL Nanosemiconductor. Details of the results were presented in a paper[1] at the European Conference and Exhibition on Optical Communication 2004 (ECOC) which took place in Stockholm from Sept. 5 to 9. Professor Arakawa had theorized back in 1982 that the operation of quantum dot lasers does not rely on temperature. Since then, prominent researchers including all members of the NL Nanosemiconductor SAB have been perusing a way to demonstrate superior temperature performance of QD lasers.

Using p-type doped quantum dot lasers, the temperature independent operation was demonstrated between 20°C and 70°C at a wavelength of 1.3 um with an extinction ration of 7dB and for the first time at a speed of 10 Gbps, a typical rate used in today's LAN / MAN optical backbones. The goal of Arakawa's team is to productize a laser by 2007 which is smaller, operates at lower power and is less expensive than present devices.

"The performance of these quantum dot lasers are far superior to that of conventional quantum well lasers. They exhibit a To of 420°K at room temperature while maintaining a clear eye opening – in other words, they have outstanding temperature insensitivity and at such high speeds." stated Professor Arakawa.

Typically, the threshold current of lasers and efficiency are sensitive to the operating temperature so it is necessary to adjust the bias and modulation currents in order to obtain a good modulated light output waveform. "The benefits are significant - by not requiring TECs (thermo-electric coolers) or having to adjust the bias and modulation currents using complex external circuitry, these lasers will open the way for higher performance and lower cost transceivers" said Alexey Kovsh, CTO of NL Nanosemiconductor, adding "In addition to temperature stability, the reduced optical feedback sensitivity of quantum dot lasers eliminates the need for an expensive optical isolator allowing further savings."

The laser developed by Arakawa's team uses quantum dot technology which has been researched over the past ten years under the direction of Prof. Zh. Alferov, the Nobel Prize winning Head of the Abraham Ioffe Institute (St. Petersburg, Russia), where NL Nanosemiconductor's technical team hail from. "It is quite gratifying to see yet further confirmation of the benefits which quantum dot technology brings to the commercial world" said Nobel Laureate Prof Zh. Alferov, adding "I expect further breakthroughs with quantum dots such as this which will revolutionize the field of semiconductor lasers."

About Nanosemiconductor GmbH

Located in Dortmund (Germany), Nanosemiconductor, originally spun-out of the Abram Ioffe Physical-Technical Institute, St. Petersburg, Russia, offers innovative compound semiconductor epitaxy products and technologies. In particular, its patented Defect Reduction Technology (DRT) and quantum dot technologies enable tangible improvements in cost, performance, and quality in compound semiconductor devices used in opto-electronics. Current applications include lasers for telecommunication, medical and industrial applications.

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[1] "20°C-70°C Temperature Independent 10 Gb/s Operation of a Directly Modulated Laser Diode Using P-doped Quantum Dots", Nobuaki Hatori (NCRC, University of Tokyo), et al, ECOC 2004.