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IEEE Photonics Society — Transforming Science into Technology™

IEEE Ottawa Section

IEEE Photonics Society Distinguished Lecturer Program

Séminaire

Le mardi 3 décembre 2019, 13h
Complexe de recherche avancée, pièce 233
Université d'Ottawa, 25, rue Templeton
Le séminaire se déroulera en anglais.

Seminar

Tuesday, December 3, 2019, 1 p.m.
Advanced Research Complex, room 233
University of Ottawa, 25 Templeton Street

Advanced semiconductor lasers:
Ultra-low operating energy and heterogeneous integration with Si photonics devices

Shinji Matsuo, NTT Photonics Laboratories, Japan

Abstract: The electrical power consumed in data transmission systems is now hampering efforts to further increase the speed and capacity at various scales, ranging from data centers to microprocessors. Optical interconnects employing an ultralow energy directly modulated lasers will play a key role in reducing the power consumption. Since a laser's operating energy is proportional to the size of its active volume, developing high-performance lasers with a small cavity is important. For this purpose, we have developed membrane DFB and photonic crystal (PhC) lasers, in which active regions are buried with InP layer. Thanks to the reduction of cavity size and the increase in optical confinement factor, we have achieved extremely small operating energy and demonstrated 4.4-fJ/bit operating energy by employing wavelength-scale PhC cavity. Reduction of the cost is also important issue because huge number of transmitters are required for short distance optical links. For this purpose, Si photonics technology is expected to be a potential solution because it can provide large-scale phonic integrated circuits (PICs), which can reduce the assembly cost compared with transmitters constructed by discrete devices. Therefore, heterogeneous integration of III-V compound semiconductors and Si has attracted much attention. For fabricating these devices, we have developed wafer-scale fabrication procedure that employs regrowth of III-V compound semiconductors on directly bonded thin InP template on SiO2/Si substrate. A key to realize high-quality epitaxial layer is total thickness, which must be below the critical thickness, typically 430 nm. Thus, membrane structure is quite suitable for heterogeneous integration. I will talk about our recent progress, focusing on ultralow-power-consumption directly modulated lasers and their photonic integrated circuit. I will also describe progress in heterogeneous integration of these lasers and Si photonics devices.

Bio: Dr. Matsuo received a B.E. and M.E. degrees in electrical engineering from Hiroshima University, Hiroshima, Japan, in 1986 and 1988, and the Ph.D. degree in electronics and applied physics from Tokyo Institute of Technology, Tokyo, Japan, in 2008. In 1988, he joined NTT Opto-electronics Laboratories, Atsugi, where he was engaged in research on photonic functional devices using MQW-pin modulators and VCSELs. In 1997, he researched optical networks using WDM technologies at NTT Network Innovation Laboratories, Yokosuka. Since 2000, he has been researching InP-based photonic integrated circuits including fast tunable lasers and photonic crystal lasers at NTT Photonics Laboratories, Atsugi. Dr. Matsuo is a member of the IEEE Photonics Society, Japan Society of Applied Physics and the Institute of Electronics, Information and Communication Engineers (IEICE) of Japan.

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