Advanced Photonic Devices Enabled by Hydride Vapour Phase Epitaxy

Sebastian Lourdudoss, Giriprasanth Omanakuttan, Axel Strömberg, Pooja Vardhini Natesan, Tofa Tajkia Syeed and Yan-Ting Sun
Department of Applied Physics, KTH - Royal Institute of Technology
Electrum 229, 164 40 Kista; Sweden

ABSTRACT

Heterojunction devices are employed in LEDs, lasers, multijunction solar cells, detectors, photonic integrated circuits and high electron mobility transistors. Most of the devices are fabricated by non-equilibrium techniques such as metal organic vapour phase epitaxy (MOVPE) and molecular beam epitaxy (MBE); this is because of their versatility in growing the advanced device structures with an accurate control of compositions and thickness to the level of an atomic layer. Hydride vapour phase epitaxy (HVPE), a near equilibrium epitaxial process, on the other hand, is versatile in selective epitaxy and in growing thick layers in short time. In this presentation, we demonstrate its usefulness in enabling higher performance of the devices fabricated by MOVPE and MBE. We exemplify with buried heterostructure quantum cascade lasers (BH-QCL) in the mid-infrared range, monolithically integrated InP based devices on silicon and InP/Si heterojunction for high efficiency solar cells. In addition, we demonstrate HVPE growth of orientation-patterned substrates for non-linear optical applications useful for generating entangled photons for quantum information and processing.