



Soutenance de thèse

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Capteurs optiques intégrés basés sur des lasers à semiconducteur et des résonateurs en anneaux interrogés en intensité

Optical sensing is of great interest for a variety of applications including quality control, disease diagnosis, biological molecule recognition, and environment monitoring. Most of the optical sensors reported in the literature use a passive interferometer such as a Mach-Zehnder interferometer, Fabry-Perot cavity, or a ring resonator based on silicon-on-insulator as the sensing device using wavelength interrogation. An external and tuneable light source is used in this case which leads to complexities in optical coupling and packaging. The purpose of the thesis is to realize ultra-compact, potentially low-cost, high-sensitivity and integrated optical sensor using intensity interrogation method.

In this thesis, optical sensing has been investigated theoretically and experimentally by exploring both hybrid integration and monolithic integration. For hybrid integration, we have demonstrated a highly-sensitive intensity-interrogated optical sensor based on cascaded Fabry-Perot laser and silicon-on-insulator ring resonator. The detection scheme employs a low-cost easy-to-fabricate Fabry-Perot laser to serve as a reference comb for the sensing ring. Its sharp emission peaks with high spectral power density result in a high sensitivity for the sensor compared to previously investigated all-passive double-ring sensor. To explore the potential monolithic integration of laser and sensing waveguide, the interface between oxide and non-oxide after oxidation of buried AlGaAs has been investigated at the Technology Centre of LPN/CNRS. The vertical oxidation of GaAs or AlGaAs with low Al content activated by a neighbouring oxidized Al-rich AlGaAs layer has been discovered experimentally. To limit the vertical oxidation and reduce the roughness of the interface, the waveguides with buried oxide layer on superlattice sample and standard sample have been fabricated and characterised. The key role of hydrogen incorporation in the activation of the oxidation process for GaAs or AlGaAs materials with low Al content has been shown experimentally. Finally, I will present the fabrication and the characterisation results of a Fabry-Perot laser working on TM mode which is an important building block for highly-sensitive monolithically-integrated circuit.

ATTENTION DATE, HEURE ET LIEU INHABITUELS

Vendredi 14 décembre 2012 à 10h

au Bât 210 – Amphi 2 (2^{ème} étage),

Université Paris-Sud – 91405 ORSAY Cedex

Vous êtes cordialement invités au pot qui suivra