Heterogeneous integration on silicon nitride for integrated photonics: lasers and nonlinear materials.

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Keywords : Integrated photonics, silicon photonics, III-V materials, lasers, nonlinear photonics, transfer-printing

Silicon (Si) and silicon nitride (SiN) photonics is a key technology in the field of integrated photonics and has experienced a rapid development over the past decade [1]. However, some functionalities such as light generation or detection that cannot easily addressed with a monolithic Si and SiN platform are desired. Heterogeneous integration using micro-transfer printing is presented here as an effective solution to address this issue. Indeed, this technology allows for efficient use of non-native materials and enables the heterogeneous integration of a wide range of devices and materials. In a first part, we will discuss here the integration of III-V semiconductors optical amplifiers (SOAs) on SiN circuits. Using this technology we will demonstrate a mode-locked laser operation in the telecom range. In a second part, we will discuss the integration of nonlinear materials ($\chi^{(2)}$ and $\chi^{(3)}$), such as gallium phosphide [3] and lithium niobate [4]. Photonic structures fabricated with theses materials will be presented.

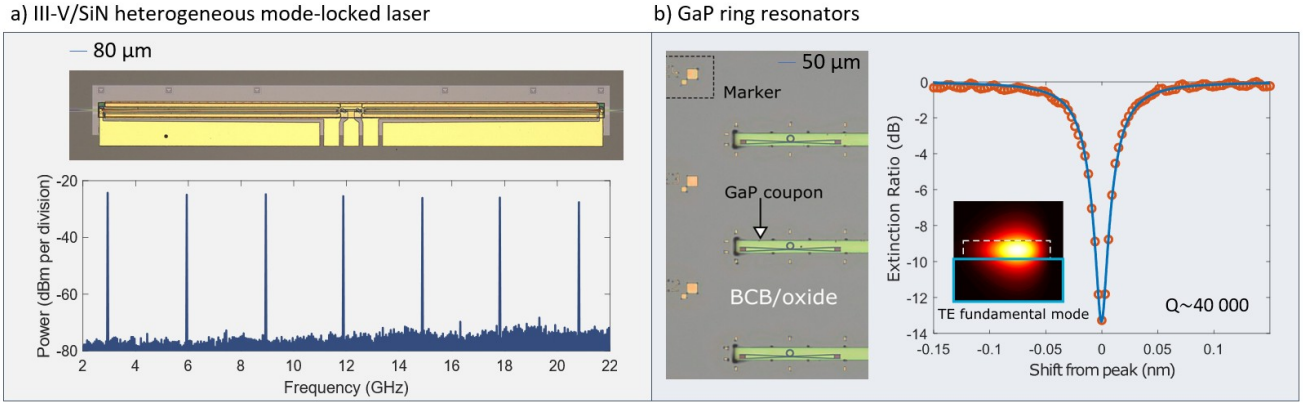

Figure 1. a) III-V/SiN heterogeneous mode-locked laser. Microscope picture of the device and radio frequency spectrum of the locked comb. b) GaP ring resonators. Microscope picture of the devices and measurement of a resonant line.

Funding. This work was supported by funding from the European Research Council (ERC) under the European union's Horizon 2020 research and innovation programme (grants agreement No. 726420, No. 759483 and No. 757800) and the Belgium "Fonds de la Recherche Scientifique (FNRS)".

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