

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

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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 [1,2]. However, some functionalities such as light generation or detection that cannot easily be 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 semiconductor 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 these materials will be presented.

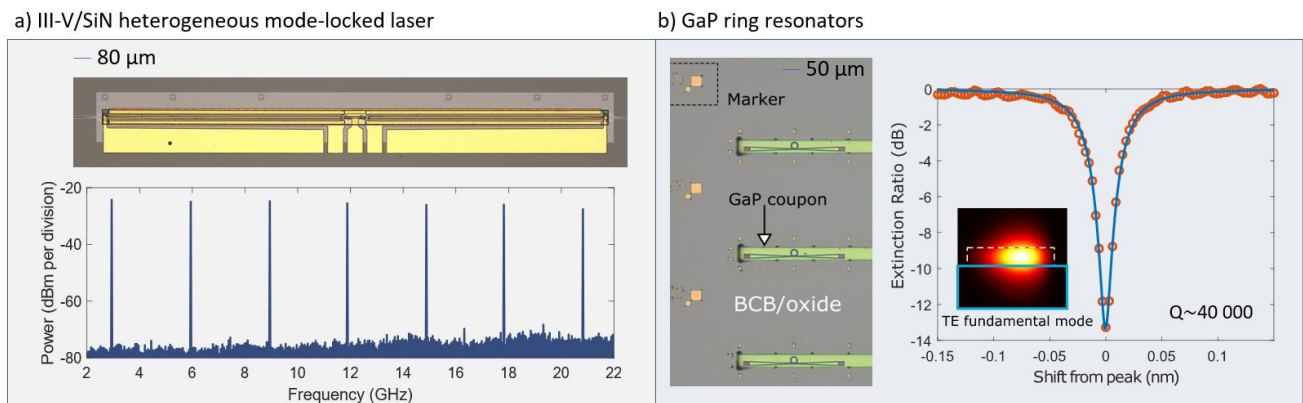


Figure 1. a) III-V/SiN heterogeneous mode-locked laser. Microscope picture of the device and radio frequency spectrum of the locked comb. b) GaP ring resonators. Microscope picture of the devices and measurement of a resonant line.

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