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Optical losses in GaP microdisks on Si with controlled random polarity

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Random quasi phase matching has been shown as a way to achieve ultra-wide spectral tunability of second order nonlinear processes.[1] In this work we investigate how this concept could be applied to III-V zinc-blende photonic devices. Pseudomorphic growth of GaP on Si allows us to explore III-V crystal polarity engineering. We demonstrate the control over the polarity domain spatial distribution, and especially the average layer polarity and the polarity domain characteristic size (Fig.1 a). We also report on the fabrication of high Q-factor microdisks based on this random-polarity photonic platform (Fig.1 b). The characterization of the linear optical properties of these resonators (Fig.1 c) allows us to demonstrate that the optical losses induced by polarity domain boundaries should not be larger than 2.5cm^{-1}, a first step towards the demonstration of random QPM in III-V photonic devices.

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[1] M. Baudrier-Raybaut, et al. *Nature*, **432** 374. (2004)
[2] R.S. Urothodi et al. Optics Letters, **45**, 4646 (2020)

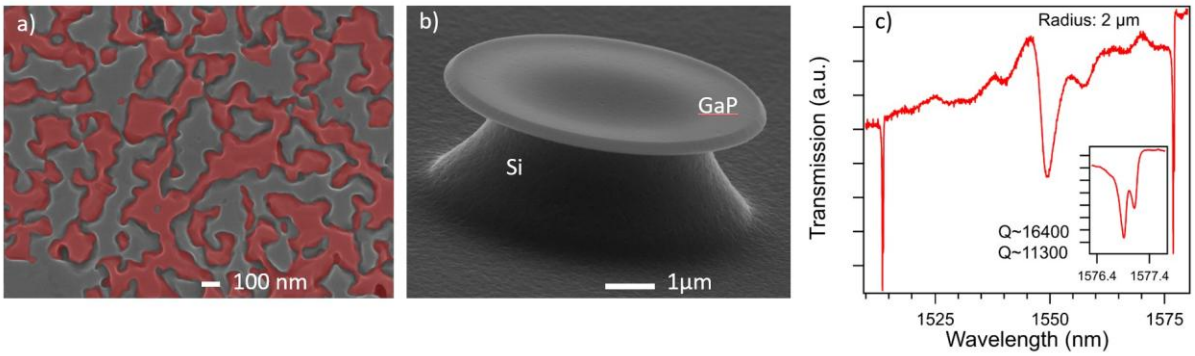

Figure 1 : a) antiphase domains in a GaP/Si epilayer, revealed by chemical etching of the antiphase boundaries. b) GaP microdisk on a silicon pedestal fabricated using such random polarity GaP/Si epilayers. c) Typical transmission spectrum in the telecom band of a random polarity GaP/Si microdisk.