CAVITY OPTOMECHANICS BASED ON EPITAXIAL GAP ON NOMINALLY (001)-ORIENTED SI BY LOW-TEMPERATURE AND SELECTIVE ETCHING

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Gallium phosphide (GaP) has received considerable attention as a suitable material for building photonic integrated circuits due to its remarkable optical and piezoelectric properties. Usually, GaP is grown epitaxially to keep its crystallinity and later transferred to silicon wafers for processing. Here, we show a promising route for the fabrication of optomechanical (OM) cavities on GaP epitaxially grown on nominally (001)-oriented Si by means of a two-steps dry etching process consisting of a low-temperature etching of GaP followed by a selective etching of the underneath silicon substrate. The low-temperature (-30 ºC) dry-etching of GaP hinders the lateral etching rate of GaP, preserving the pattern with a deviation, between the design and the pattern in the GaP layer, lower than 5%. This way the complex process of bonding a GaP wafer to a silicon-on-insulator wafer can be avoided. To demonstrate the quality and feasibility of the proposed fabrication process, we build suspended OM nanobeam cavities by low-temperature and selective etching. The cavities show optical quality factors between 103 and 104, and mechanical resonances around 3.1 GHz. Both optical and mechanical resonances are close to other structures reported in the literature. Our results suggest a simple and low-cost way to build GaP-based photonic devices directly integrated on industry-standard Si(001) photonic wafers.