Low roughness microdisk resonators fabricated by Focused Ion Beam (FIB)

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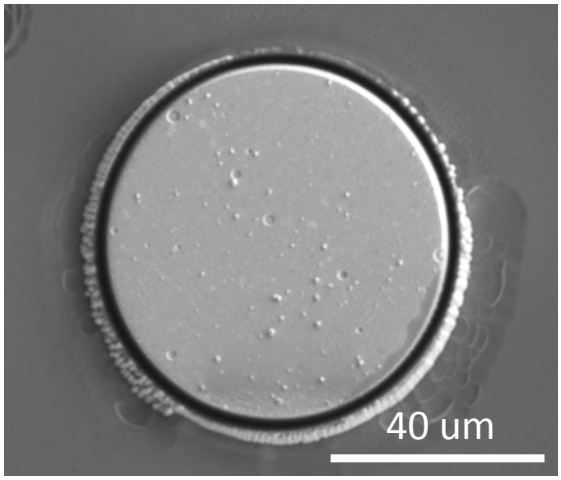
In this work we present a new approach for the fabrication of microdisk resonators using a focused ion beam (FIB) [1]. This technique is very efficient, enabling the placement of the devices at any regions of a sample, facilitating a possible monolithical integration. Moreover, it allows the production of very low roughness walls[2].

Figure 1 shows a SEM micrograph of the InP/InGaAsP quantum wells (QW) microdisk resonator with 65μm diameter, fabricated by this new approach. This microdisk resonator has a p-InGaAs layer contact for current injection at the top. The active region has InGaAs/InGaAsP QWs sandwiched between InP pedestals.

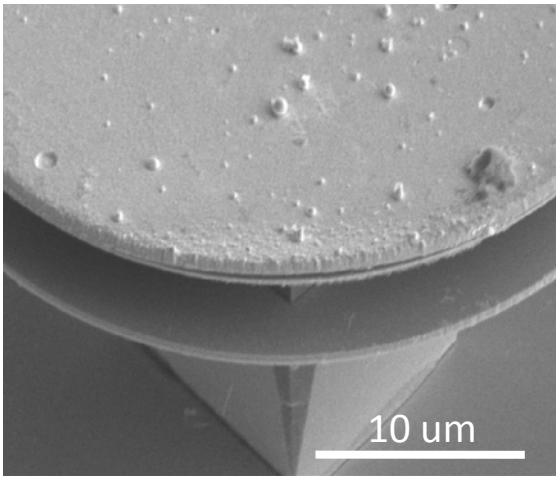
This microdisk resonator is fabricated as follows: First, metal microdisks are deposited by conventional lift-off technique. Subsequently, cylindrical posts are defined by a milling process using FIB. This last step is done first with a higher current, for removal of the field around the microdisk and the second, with a lower current, to smooth the walls of the microdisks. To finish the process and form the pedestals of the microdisks, we used a selective wet etching with H_2O and HCl. The details of the processes, electrical and optical characterization of this resonator will be presented.

1 - L. A. Giannuzzi and F. A. Stevie *Introduction to Focused Ion Beams: Instrumentation, Theory, Techniques and Practice* (Springer 2004)

2 - J. E. Heebner, T. C. Bond, J. S. Kallman, *Generalized formulation for performance degradations due to bending and edge scattering loss in microdisk resonators*, Optics Express, Vol. 15, Issue 8, pp. 4452-4473, (2007).



1(a)



1(b)

Figure 1. SEM images of the InGaAs/InGaAsP Quantum Wells microdisk resonator with 65μm diameter. (a) Top view before selective wet etching. (b) Lateral view after selective wet etching.