Cavity Resonator Integrated Grating Filters fabricated by soft-mold nanoimprint lithography

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Abstract— Cavity Resonator Integrated Filers are a novel generation of free space filters that rely on efficient coupling of a free space beam to a localized mode. We introduce the physical principles underlying their optical properties, and show that soft mold nanoimprint lithography is particularly adapted for their fabrication. We experimentally demonstrate high efficiency ($\simeq 50\%$) narrow band (300 pm) filters at 850 nm wavelength.

Cavity Resonator Integrated Filters (CRIGFs) are a new generation of sub-wavelength grating filters. They have been introduced by S. Ura [1] a few years ago. Their basic geometry is depicted on fig.1. It consist of planar waveguide on which are defined a grating coupler (GC) central section surrounded by two lateral distributed bragg reflectors (DBRs) sections. Phase Shift (PS) sections allows the formation of a resonant localized mode under the GC section. The GC then ensure outcoupling of the localized mode to the free space beam. As GMRFs, such filters can be made almost arbitrarily narrow band, but contrary to GMRF filters, they exhibit a high angular tolerance which allows their use with tightly focused beams [3].

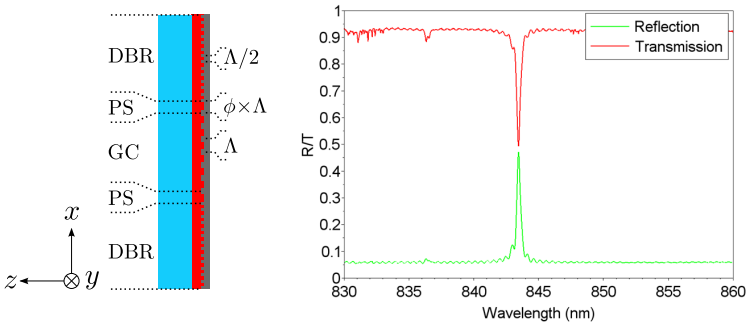

Figure 1: left : basic geometry of a CRIGF filter. Right : experimental reflectivity and transmission spectra of a fabricated CRIGF filter.

In this paper, we will discuss the origin of their extraordinary properties and we will show that they can be efficiently fabricated by soft mold nano-imprint lithography. Using this fabrication, technique, narrow band filters of 330 pm FWHM at 850 nm (see fig 1.) were demonstrated, and ultra-narrow band ($\simeq$ 150 pm at 850 nm wavelength) resonances were experimentally observed. The experimental results and performances of such filters will be presented and discussed.

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