Angled MMI CWDM structure on Germanium on Silicon

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There are several examples of angled multimode interferometers (AMMI) [1, 2], arrayed waveguide gratings (AWGs)[3] and echelle gratings/planar concave gratings (PCGs) [4] in SOI as these are the most widely used components to perform wavelength division multiplexing [5]. While the last two usually require an extra lithography step to improve insertion loss and crosstalk and a very fine control of the fabrication procedure to improve the spectral response, the AMMI requires a single lithography and etching step and it is more tolerant to fabrication errors. In this paper we demonstrate the first angled multimode interferometer (AMMI) fabricated in the germanium-on-silicon material platform.

The device was fabricated on 1.75μm thick germanium on silicon with a 60nm SiO_2 overlayer. This material has already been used for AWGs and PCGs designs [6]. The AMMI dimensions were 50μm width by 10mm length for the multimode region, 14μm width for the input and output tapers and 0.28rad angle between the tapers and the multimode region. The rib waveguides were 2.1μm wide. The patterns were defined on ZEP-520A by e-beam and ICP etched by 1.15μm.

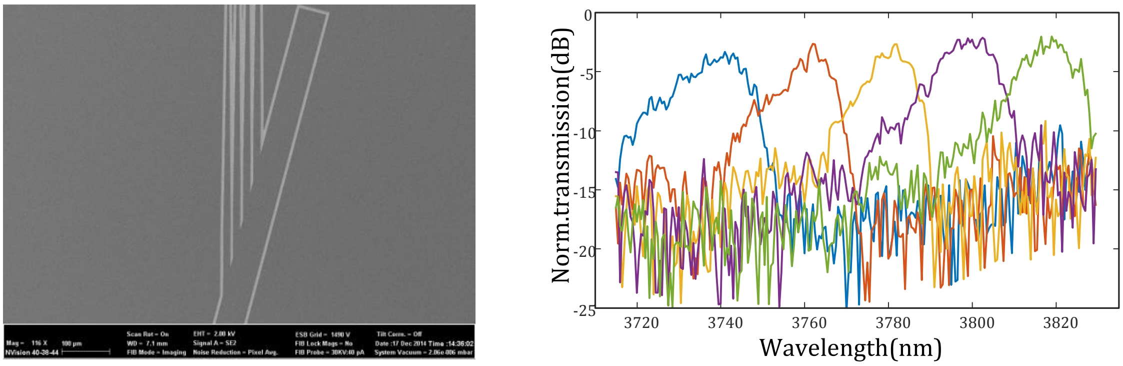

Fig. 1 Left SEM image of the output section of one of the AMMI fabricated in the same chip, right output of the 5-channel AMMI.

The waveguide propagation loss was measured at 1.4 ± 0.24dB/cm, at wavelengths between 3.715μm and 3.835μm, applying the effective cut-back method where waveguides of different lengths were measured. Light was coupled from a quantum cascade laser via surface grating couplers fabricated in Ge. The measurements for the AMMI revealed approximately 3dB insertion loss, −10dB crosstalk and 20nm channel spacing. We suspect that the noise floor is making the crosstalk artificially lower. Improved grating couplers should address this issue. Simulations suggest that by slightly increasing the thickness of the material the insertion loss and the channel spacing could also be decreased.

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