Arrayed waveguide grating in InP membrane on silicon patterned by 193-nm deep UV lithography

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We demonstrate an almost twofold improvement in insertion loss, crosstalk and channel non-uniformity of AWGs in InP membranes by using 193-nm deep UV lithography compared to our previous EBL results.

Significant performance improvement over electron beam lithography

Recently we demonstrated that deep UV lithography significantly improves the performance of AWGs in ridge-waveguide photonic ICs [1]. In InP membranes, critical dimension control across dense photonic structures, like AWGs, remains challenging. This is due to the long scattering distance of electrons (30 µm in InP substrates) in electron beam lithography. Proximity error correction is unable to fully correct the background electron dose. Optical lithography does not suffer from the electron scattering problem which improves critical dimension control. In this paper we demonstrate that key performance parameters of AWGs in InP membranes are improved by almost a factor of 2 by switching to 193 nm deep UV lithography (Fig. 1).

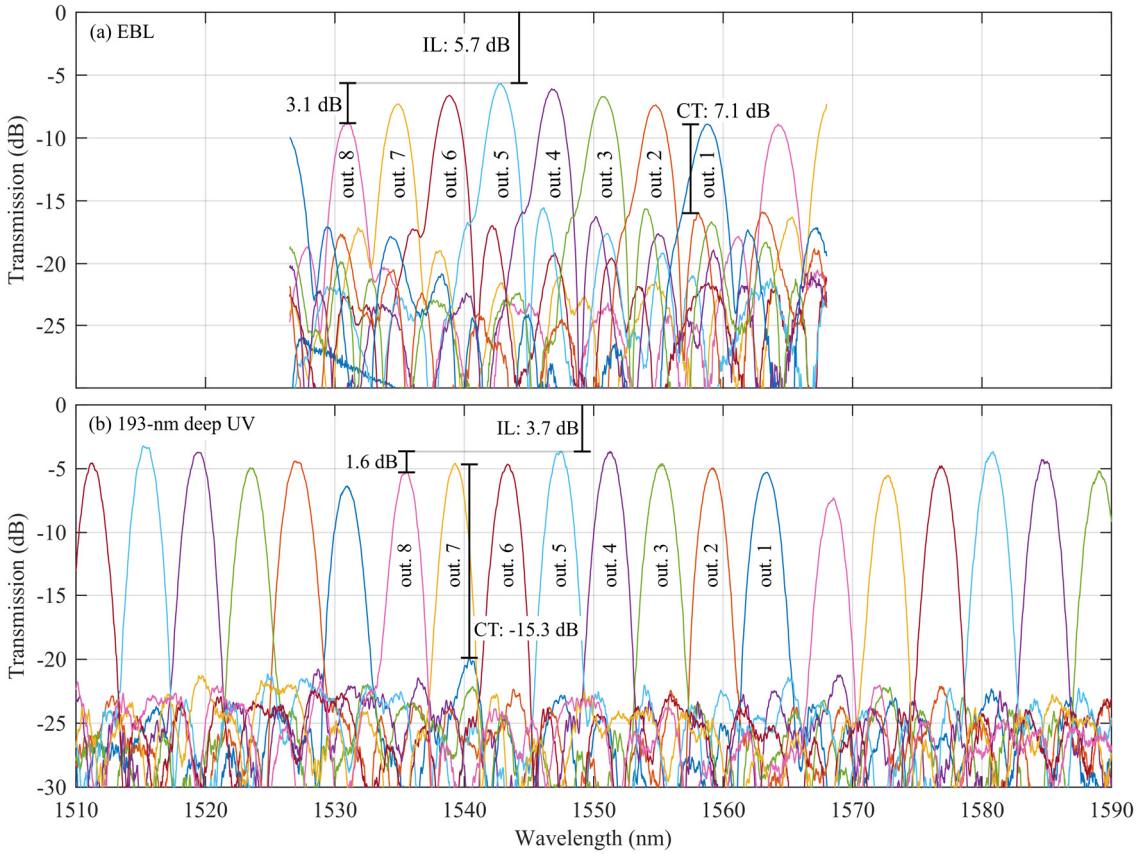

Fig. 1. Transmission spectra of AWG from the center input channel to the 8 output channels using (a) EBL [2] and (b) deep UV. Insertion loss (IL), crosstalk (CT) and channel non-uniformity are indicated.

References

[1] J. Bolk et al., "Deep UV lithography process in generic InP integration for arrayed waveguide gratings," IEEE Photonics Technology Letters, vol. 30(3), 2018.

[2] X. Zhang et al., "Reflecting AWG by Using Photonic Crystal Reflector on Indium-Phosphide Membrane on Silicon Platform," IEEE Photonics Technology Letters, vol. 3(13), 2019.