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Low loss SiN Photonics: From Prototype to Volume Offering

Silicon Nitride (SiN) has attracted much attention as a suitable PIC material due to its large transparency window (400 - 4000 nm), low loss (at least one order of magnitude lower than Silicon), high optical power operation (above 10 W under continuous wave laser demonstrated), and CMOS compatible material, therefore scalable to volume.

Thick SiN PICs have been widely investigated and served a vast variety of applications. In this talk we will review applications such as:

1) Laser integration: Among the SiN PICs' applications in the laser field [1,2], a hybrid InP/SiN tunable laser based on microring resonators exhibiting 40mW fiber-coupled output power and 5kHz linewidth has been very recently demonstrated.

2) Array waveguide gratings for telecom and sensing: Owing to highly uniform layer depositions, low temperature sensitivity and a lower dependence on waveguide cross-section variations compared to silicon-on-insulator platforms, AWGs with excellent performance have been fabricated in several wavelength bands (900 nm, O-band, C-band) on the SiN PIC platform [3], with specifications such as polarization independent behavior, channel spacings between 0.4 nm and 25 nm, or cross-talk levels < -30 dB demonstrated.

4) Quantum processor: The combination of low-loss fiber to chip coupling, high optical confinement and low propagation loss of SiN PICs enables squeezed states and the possibility to build a quantum computer. [4,5].

6) Nonlinear photonics: The chi3 nonlinearity in SiN waveguides and resonators can be used to enable optical frequency comb generation [6] and supercontinuum light generation. A myriad of applications are on the horizon including low noise RF-generation, 6G, Telecommunication and LiDAR.

References

[1] Guo et al., IEEE Xplore (2021)
[2] Calò et al., OFC (2022)
[3] Cheung et al., IEEE (2020)
[4] Arrazola et al., Nature (2021)
[5] Zhang et al., Nature Communications (2021)
[6] Tetsumoto et al., Nature Photonics (2021)