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Ultra-Broadband THz Transition from CPW to Si Rod Waveguide for Future Tbps On-Chip Communications

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Recently, terahertz (THz) Si waveguides were utilized as interconnects for cost-effective high data rate (>100 Gbps) on-chip communications thanks to their low loss and low dispersion characteristics [1,2]. However, in [1,2], the Si waveguides were excited from hollow waveguides which limits their operational frequency range to a specific rectangular waveguide (WR) band. Moreover, excitation from a WR prevents from integrating Si waveguides with additional active sources or detector chips which is required for future beyond 100 Gbps transceivers.

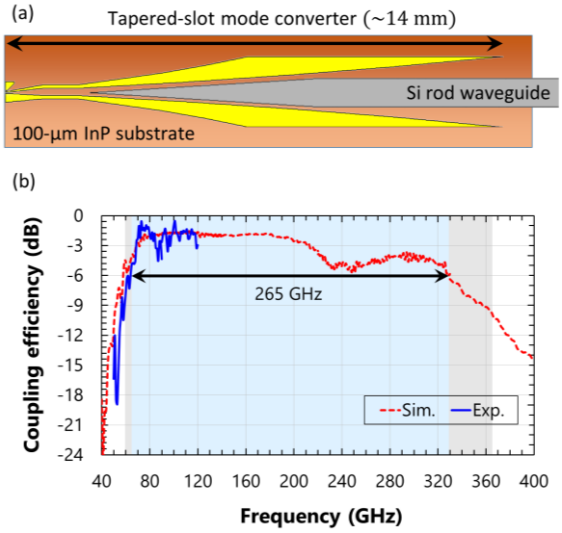

Fig. 1 (a) Schematic of tapered-slot mode converter coupling from InP CPW to Si DRW. (b) Measured and simulated coupling efficiency from InP CPW to Si DRW.

In this article, we propose a broadband planar transition between InP-based coplanar waveguide (CPW) and Si dielectric rod waveguide (DRW) [2] using a tapered-slot mode converter [3] as shown in Fig. 1(a). The use of InP targets future monolithic integration with high-power uni-traveling-carrier photodiodes, a promising technology for ultra-broadband THz sources [4]. Experimental results show a coupling efficiency from the InP-based CPW to the Si DRW of about -2 dB in the frequency range of 70-120 GHz and a lower cut-off frequency of 65 GHz (Fig. 1(b)), which agrees with numerical simulation. According to simulations, the 6 dB bandwidth is 265 GHz. Further experimental characterization at different frequency bands will be reported at the conference site.

In conclusion, the proposed planar transition yields broadband operation and is a promising technology for integrating photonic THz active devices with dielectric interconnects for future on-chip Tbps communication.

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