

The Si-Photonic Modulator Using Three-Waveguides Coupler Structure

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Abstract—We proposed and demonstrate the Si-modulator using three-waveguides coupler structure for the first time. By using three-waveguide structure can decrease the coupling length contrary to conventional directional coupler structure. For the modulation operation, *pn* diode is employed to have junction at the only one waveguide. The proposed structure was fabricated using CMOS-compatible process and shows the compact device size about $\sim 500 \mu\text{m}^2$ which is much smaller than MZI modulator structure. By applying forward bias voltage of 1.2 V, π -phase shift is achieved with $V_{\text{sv}} \cdot L \sim 0.23 \text{ V}\cdot\text{mm}$. Finally, it shows operation speed up to 3 Gbps with extinction ratio of 3 dB which is faster than carrier injection using *p-i-n* diode. It can affordable for the operation speed up to 3 Gbps using carrier injection of *pn* diode by applying forward bias. We expect that performance of device can be enhanced using more sophisticated fabrication process and can be used as the new structure of Siphotonic modulator.

IndexTerms—Si-photonics, optical modulator, waveguide coupling, electro-optic effect.

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