Experimental Investigation of Four-Wave Mixing Effect in Quantumn-Dot Semiconductor Optical Amplifier Physics

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Four-wave mixing (FWM) effect has been widely investigated in semiconductor optical amplifiers (SOAs) [1], highly-nonlinear fiber (HNLF) [2] and silicon waveguide [3] as a technique for all-optical signal processing. Recently, quantum-dot SOA (QD-SOA) has been developed due to its evident advantages, such as faster gain recovery, ease of integration, and high conversion efficiency (CE) [4]. In this paper, the experimental characterization of FWM in QD-SOA is presented and the good performance is achieved, which demonstrates that QD-SOA is suitable nonlinear media for FWM-based all-optical processing.

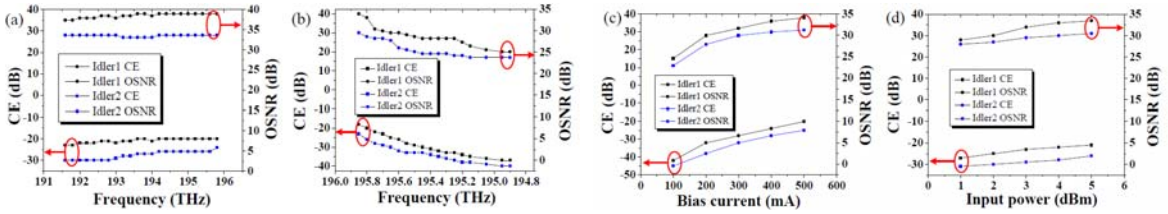

Fig. 1(a) CE and OSNR vs frequency; (b) CE and OSNR vs detuning; (c) CE and OSNR vs bias current; (d) CE and OSNR vs. input power.

Figure 1 shows the measured results for conversion efficiency and optical signal-to-noise ratio (OSNR) of the converted FWM signals after QS-SOA. In Fig. 1(a), we set the frequency detuning as 100GHz, bias current as 500mA, and change the wavelengths of two inputs. The CE and OSNR are almost flat with different wavelengths. In Fig. 1(b), one of the light is set as 195.9THz, then change the other light from 194.9 to 195.9THz. It is seen that CE and OSNR deteriorate with the expansion of detuning. In Fig. 1 (c), other conditions are kept (laser1:191.3THz, laser2:191.4THz) and only bias current is changed from 100 to 500mA. The CE and OSNR improve with the raise of bias current. In Fig. 1(d), the total input power is changed from 1 to 5dBm, and similarly, the larger input power leads to better CE and OSNR performance.

We have characterized the properties of QD-SOA and experimentally demonstrated the feasibility of FWM in QD-SOA. The high CE and large OSNR guarantee the good performance of the converted idlers. Therefore, QD-SOA has the potential to be applied in FWM-based all-optical processing.

Reference

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