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Performance on SOA Based Wavelength Conversion at 10 GB/s by dual pump four wave mixing over a 50 nm

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Abstract – We demonstrate an 50 nm wavelength shift using two orthogonally polarized pump with four wave mixing .We show that the wavelength conversion using of a four wave mixing in SOA ,increases the error free conversion .50 nm wavelength down conversion 35nm up conversion have been obtained at10 Gb/s. This results a significance improvement over the previous best performance of an Fwm based wavelength converter and demonstrate the large wavelength shift capacity of Fwm technique.

Index Terms – Semiconductor optical amplifier, four wave mixing, optical network, wavelength conversion, frequency conversion communication system.

I. INTRODUCTION

Wavelength conversion using four waves mixing in SOA is transparent to bit rate and modulation format and it is fully Tunable over a wide range of wavelength. Fully Tunable optical wavelength converters that operate over a wide range of wavelength are potentially useful device for future optical network. Four wave mixing in semiconductor optical amplifier is a promising technique for wavelength conversion of an arbitrary input signal wavelength to any other wavelength within the SOA bandwidth using Tunable pump sources .The limitation of the conventional Fwm technique are mainly due to the polarization sensitivity but also to the gradual degradation of the conversion efficiency and signal to background noise ratio and the wavelength shift increases. The use of Fwm in optical network is possible only if high conversion efficiency and high signal to noise ratio can be achieved. Two options are available to increase SNR [7]

i. Use of high input power
ii. Use of long amplifier.

Increases of the efficiency of approx 50 Db and of the SNR of 23 Db were obtained. Wavelength conversion based on FWM in SOA and working at a bit rate as high as 10 gb/s with low Bit error rate degradation [4]. With using the broad band orthogonally pump scheme [10]. Demonstrated that the potentially of the FWM for large wavelength shift. Dual pump scheme [11] has been proposed in the past in order to achieve either polarization insensitivity. Polarization insensitivity demands orthogonally polarized. Two main advantages are offered by the Dual pump FWM relative to the conventional single pump scheme .firstly, its potential to cover the whole range of the SOA bandwidth with high efficiency, Secondly, Generation of more than one converted signal simultaneously at different wavelength .Parallel and Orthogonally pump are considered .Finally reported that wavelength conversion based Dual pump FWM in SOA increases [11] the conversion interval previously reported at BER value better than 10^{-9}. The pump and probe input power level are indicated by the arrow on the vertical axis .

The conversion efficiency of the NDFWM, which is defined as the ratio of the fwm signal output to the probe input power. FWM converters are linked to good efficiency and noise properties of the conversion process. Efficiency and noise have been thoroughly studied for different conversion detuning and injected pump power, but usually at fixed pump wavelength.

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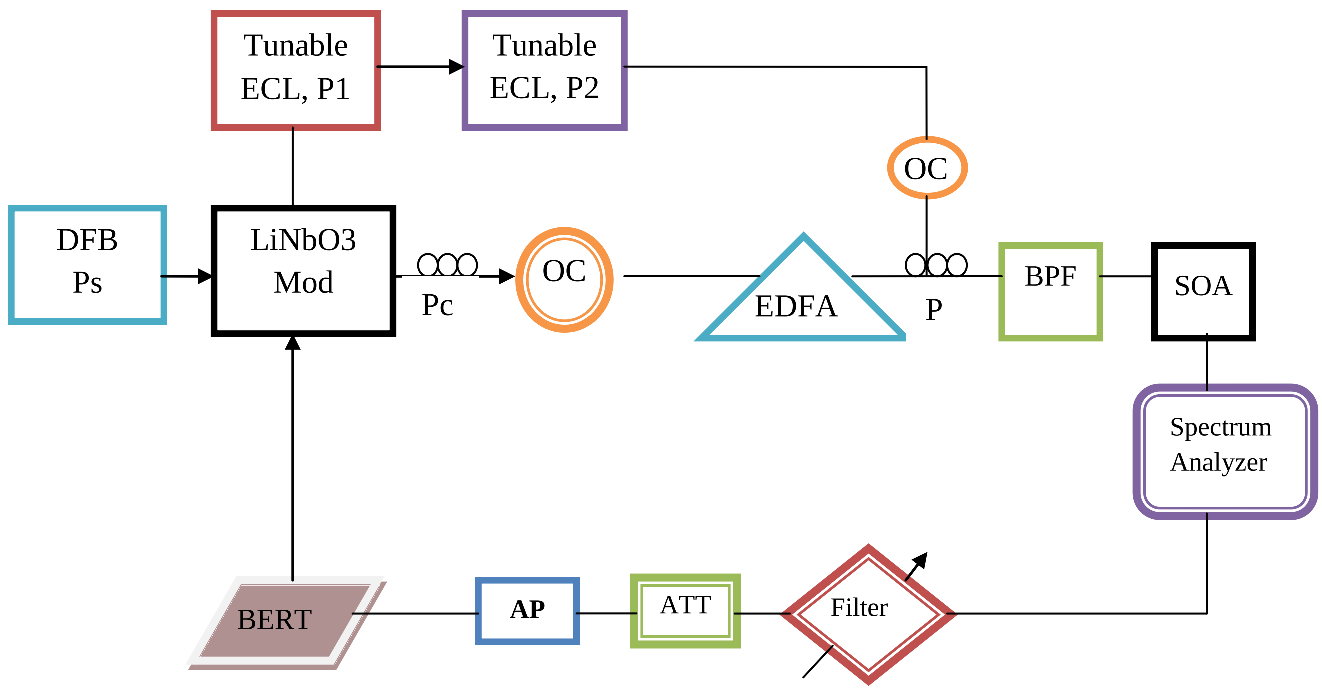
Experimental Set up and Operation Principles



II .EXPERIMENTAL SET UP

Fig1, show that the experimental set up in this system, the input signal was modulated by a LiNbo3 Mach Zender external modulator at 10 GB/s with a [10] Pseudorandom sequences. Input signal and the Tunable laser pump coupled into the BPF and SOA through optical coupler. Pump 1 fixed at a wavelength of 1530nm and optical power is 3.25dbm. Pump2 fixed at a wavelength at a wavelength of 1600nm and optical power is of -2.3dbm .Input signal is 1530nm .optical power is assumed to be -7dbm. Gain of SOA can simply be increased by raising the bias current to the SOA but the ultimate gain is limited by thermal effect and amplified spontaneous emission at high injection level .power ratio between the pump and the signal is kept constant at about 10db, it is measured at the output of the SOA [9]

III RESULTS AND DISCUSSION

Conversion efficiency is defined as the output power of the shifted signal divided by the input signal power .SNR is defined as the signal power to noise power. Conversion efficiency and SNR shown in **Fig1** .SNR as usual remain high over 100 nm .and conversion efficiency flat over 100nm.Showing through set up that output wavelength is less than 1530nm and greater than 1560nm,conversion efficiency begins to Detroiter. This effect is gaining due to the reduction in gain of the SOA,.However, there is no corresponding drop in OSNR, since the output signal power is proportional to the gain at Pump 2 and the noise in this spectral region is also roughly proportional to the gain. All results presented here are for wavelength conversion from shorter to longer wavelengths; we expect that similar SNR and conversion efficiency will be possible for wavelength conversion from longer to shorter wavelengths.

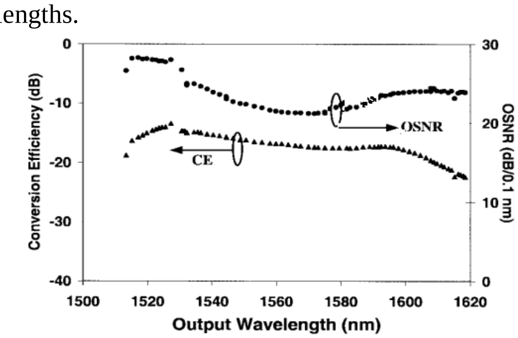


Fig. 1 Conversion efficiency and signal-to-background ratio versus output wavelength for a fixed input wavelength of 1530 nm.

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Fig2. Cascading this entire component EDFA, BPF, SOA and output of the ATT. Photo detector measures the waveform at the output spectrum analyzer. Three different pump signals detuning in down and up conversion configuration .In this resolution bandwidth is set to 0.1nm.Max detuning in down conversion is limited to 50nm of Bandwidth of the filter placed in front of SOA; while up conversion is limited to 35nm by the converted signal to noise ratio. Output power should be reported 10.5db, lower than input power. The output shown in **Fig 2**. High value of the output coupling loss under high saturation of SOA, which is caused by self focusing effect. It is experimentally verified by using a SOA in which the distance for optimum coupling between the output lenses fibre and the SOA was reduced for high optical injections. The small peek is assumed at 1579.5 nm in Fig 2 (b) is due to a side mode of the pump.

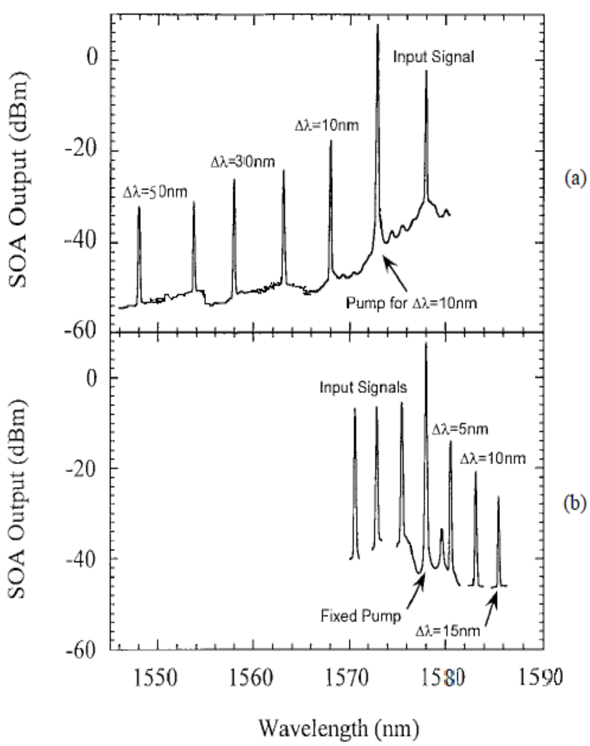
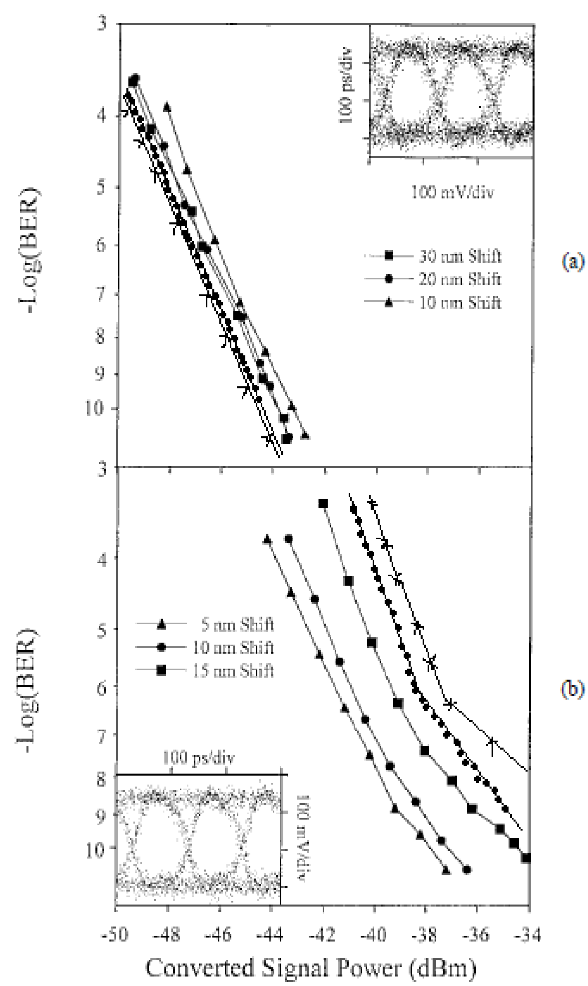


Fig2. (a) Down-conversion. The signal wavelength is fixed at 1579nm and the pump wavelength is shifted. (b) Up-conversion. The pump is at 1579 nm and the signal is shifted.

Fig3. To finds out the BER versus power. Fig 3A determines the BER verses power for down shift given for the same value of pump signal. The spectral dependence of the receiver sensitivity does not allow an easy comparison of the BER curve, that is why it should be observed down conversion of the BER curves(parallel).Total shift of 50 nm covers the whole useful bandwidth of the EDFA .On the other hand BER verses power for up shift. The degradation is more evident is due to the induced SNR.BER curves are parallel in the case of down conversion. In the case of up conversion a degradation of BER curves is obtained .Conversion efficiency is lower and the ASE is higher for the up conversion.

Fig3 BER versus power for selected (a) down-shift and (b) up-shift. In the inset, the eye diagram for the largest value of wavelength shift is reported



IV CONCLUSION

We demonstrated that an Ultra broad Band wavelength conversion over 50nmusing double pump FWM in SOA. Power penalty is less than 1 db at BER of 10 powers -9 for a 50 nm shift of a 10 GB/s signal. Finally, reported that the largest wavelength shift using FWM.

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BIOGRAPHY

Shreyashree Verma, I have done B.Tech from Amity University Lucknow and M.Tech from SHIATS. I am presently doing Reaserch on optical communication.