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Broadband gain-clamped linear quantum dash optical amplifiers

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Abstract The linear optical gain of gain-clamped quantum dash semiconductor optical amplifiers (GCSOAs) has been investigated using the rate equation model. The gain spectrum of GCSOA for different wavelength detuning and different doping has been studied. Our analysis shows that the linear gain can be increased as the laser wavelength is detuned to high wavelength where the peak of the optical gain, which is found at wavelengths below the ground state wavelength, is shifted to lower wavelength as the laser wavelength is increased. We find that doping the dashes by either N-type or P-type enhances the linear optical gain and shifts the gain peak to lower wavelength. Moreover, we found that GCSOA with lightly N-type doping demonstrates large separation between the laser and the amplifier wavelength. Also we find that small inhomogeneous line broadening enhances the linear gain peak, shifts the gain peak to wavelength lower than the GS wavelength and widens the gain spectrum.

Keywords Quantum dash · Linear optical amplifier · Gain-clamped · Doping

1 Introduction

Semiconductor optical amplifiers (SOAs) are one of the most promising key components in modern optical networking and photonics systems. Linear amplifiers are essential amplifiers in modern optical networks where the operating wavelengths are extended outside the operating wavelength range of erbium-doped fiber amplification. There is great attention to develop broadband linear optical amplifiers since conventional multichannel semiconductor optical amplifiers are characterized by large crosstalk between channels and significant intermodulation distortion due to the dependence of the gain on the optical power. To overcome these drawbacks, gain-clamped semiconductor optical amplifiers (GCSOAs) have been proposed and demonstrated (Wolfson et al. 1998; Michie et al. 2007; Chen et al. 2006; Park et al. 2003;

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