STRAINED QUANTUM WELL HETEROSTRUCTURE: MODELING AND SIMULATION OF 980 nm LASER

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ABSTRACT

This thesis concerns the study of a strained quantum well laser diode emitting at wavelength of about 980 nm which is suitable for pumping Er^{3+} doped fiber amplifiers. The concept of a strained quantum well in the design of the active medium of the laser diode is discussed. A model is proposed that incorporates features of the physical structural factors and characteristics of the structure. The theoretical background linked directly to the simulation of the model is to provide calculations and derivations of the optical properties of the modeled structure. Theoretical calculations were made taking into account the variation of the optical gain due to the influence of the level of the carrier concentration and strain induced in the quantum well active medium. Based on the simulation, an analysis of the characteristics of the simulated model was performed and comprehensive description of the characteristics due to the structural behavior given. Within the spectral range of 1.20-1.40 eV (wavelength 886 – 1034 nm), the results are reasonable and consistent with the basic principles employed in the optical properties of quantum well lasers and will be useful for designing optimized strained quantum well lasers.

ABSTRAK

Tesis ini adalah berkaitan dengan pengajian diod laser telaga kuantum teregang yang memancarkan panjang gelombang berhampiran 980 nm yang sesuai untuk mempamkan amplifier fiber terkandung Er^{3+}. Konsep bagi telaga kuantum teregang dalam reka bentuk medium aktif diod laser dibincangkan. Satu model yang mengabungkan ciri-ciri faktor struktur fizik dan sifat-sifat struktur dicadangkan. Latar belakang berdasarkan teori yang berhubung secara langsung dengan penyerupaan model adalah untuk membekalkan pengiraan dan terbitan ciri-ciri optik struktur yang dimodelkan. Latar belakang belakang berdasarkan teori telah dilakukan dengan mengambil kira perubahan gain optik yang disebabkan oleh pengaruh kepekatan pembawa dan regangan yang teraruh di dalam medium aktif telaga kuantum. Berdasarkan simulasi, satu analisis bagi ciri-ciri model yang disimulasi telah dijalankan dan penghuraian komprehensif diberikan bagi ciri-ciri yang disebabkan oleh sifat-sifat struktur. Dalam lingkungan spektra 1.20 – 1.40 eV (panjang gelombang 886 – 1034 nm), keputusan adalah munasabah dan konsisten dengan hukum-hukum yang digunakan dalam ciri-ciri optik laser telaga kuantum dan adalah berguna untuk reka bentuk laser telaga kuantum teregang yang optimum.

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CONTENTS

LIST OF FIGURES

LIST OF TABLES