ANALISIS PENGARUH IMPLANTASI ION KARBON DAN BORON DI ATAS SUBSTRAT Si:As TERHADAP KARAKTERISTIK STRUKTUR DAN INTENSITAS FOTOLUMINESEN

SKRIPSI

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar Sarjana Sains
Departemen Pendidikan Fisika Program Studi Fisika Konsentrasi Fisika Material

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ABSTRAK

Silikon merupakan material semikonduktor yang tepat untuk dijadikan bahan penyusun IC optoelektronik. Namun, silicon mempunyai keterbatasan pada suhu operasi yang rendah untuk mengemisikan cahaya. Oleh karena itu, tulisan ini bertujuan untuk mengatasi masalah pendinginan suhu pada silicon. kami melakukan implantasi pada silicon dengan ion karbon dan boron untuk meningkatkan probabilitas rekombinasi radiatif. Sebelum melakukan implantasi, telah dilakukan simulasi untuk memprediksi kedalaman cacat yang dihasilkan menggunakan aplikasi SRIM. Terdapat tiga konfigurasi yang digunakan pada penelitian ini yaitu: substrat diimplantasi ion karbon 30 keV (W1A), karbon 30 keV + karbon 30 keV (W2A) dan karbon 30 keV + karbon 30 keV + Boron 10 keV (W2D). Hasil implantasi dikarakterisasi dengan *photoluminescence spectroscopy* pada suhu lingkungan 10-300 K untuk mengetahui karakteristik intensitas, panjang gelombang fotoluminesen sampel. Hasil simulasi menunjukkan bahwa distribusi ion sampel W1A, W2A dan W2D berturut-turut berada pada 835.2, 836.4, 683.5 Å. Jumlah *vacancies* tertinggi pada sampel W1A dan W2A hampir sama, yaitu berada pada kedalaman ~830 Å dan pada sampel W2D vacancies banyak terjadi pada kedalaman ~500 Å. Hasil karakterisasi fotoluminesen spektroskopi menunjukkan terdapat 2 puncak intensitas pada Panjang gelombang 1100 nm dan 1165 nm. Intensitas sampel W2D memiliki intensitas paling tinggi disbanding sampel W1A dan W2A. hal itu dikarenakan ion implantasi karbon boron dapat membuat loop dislokasi yang menghilangkan penghalang spasial sehingga rekombinasi radiative meningkat. Oleh karena itu, konfigurasi sampel W2D lebih baik dalam mengemisikan cahaya dibandingkan dengan konfgurasi pada W1A dan W2A. hal itu dikarenakan ion boron dapat membentuk loop dislokasi yang dapat meningkatkan intensitas luminesen.

Kata Kunci: Ion Implantasi, Silikon, Fotoluminesen, Karbon, Boron, *Quenching Temperatur*

ABSTRACT

Silicon is the right semiconductor material to be made up of optoelectronic ICs. However, silicon has a limitation on low operating temperatures to emit light. Therefore, this paper aims to overcome the problem of cooling temperatures in silicon. we implanted silicon with carbon and boron ions to increase the probability of radiative recombination. Prior to implantation, simulations have been carried out to predict the depth of defects produced using the SRIM application. There are three configurations used in this study, namely: the substrate is implanted with 30 keV carbon ions (W1A), 30 keV carbon + 30 keV carbon (W2A) and 30 keV carbon + 30 keV carbon + 10 keV Boron (W2D). The results of implantation were characterized by photoluminescence spectroscopy at ambient temperatures of 10-300 K to determine the characteristic intensity, wavelength of photoluminescent samples. The simulation results show that the ion distribution of the W1A, W2A and W2D samples are respectively at 835.2, 836.4, 683.5 Å. The highest number of vacancies in W1A and W2A samples is almost the same, which is at a depth of ~ 830 Å and in the W2D sample many vacancies occur at a depth of ~ 500 Å. The results of spectroscopic photoluminescent characterization showed that there were 2 peak intensities at wavelengths of 1100 nm and 1165 nm. The intensity of the W2D sample had the highest intensity compared to the W1A and W2A samples. that is because the carbon boron ion implantation can create a dislocation loop that removes the spatial barrier so that the radiative recombination increases. Therefore, the configuration of the W2D sample is better at emitting light compared to the configuration of W1A and W2A. that is because boron ions can form dislocation loops which can increase luminescent intensity.

Keyword: Ion Implantation, Silicon, Photoluminescence, Carbon, Boron, Quenching Temperatur

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