THURSDAY

Sym. B : Compound Semiconductors for Electronic & Photonic Devices
GaAs & InP RELATED MATERIALS
D-THU-05

RADIATION DAMAGE IN InGaP/InGaAs P-HEMTs BY 20-MeV ALPHA RAYS, H. Ohyama and T. Hakata (Kumamoto National College of Technology, 2659-2 Nishigoshi Kumamoto, 861-11 Japan), S. Kuroda (Fujitsu quantum devices Ltd., Yamanashi, Japan), E. Simoen and C. Claeys (IMEC, Belgium), Y. Takami (Rikkyo University, Kanagawa, Japan), H. Sunaga (Takasaki JAERI, Gunma, Japan)

Results are presented of a study on the degradation behavior of InGaP/InGaAs pseudomorphic HEMTs by 20-MeV alpha ray irradiation. N-InGaP/InGaAs HEMTs fabricated on undoped $In_{0.2}Ga_{0.8}As$ channel layers with 14 nm thickness are used.

Both gate length and width are 10 μm. HEMTs were irradiated by a 20-MeV alpha ray at room temperature by the AVF cyclotron in TIARA at Takasaki JAERI. After irradiation, the drain source current (I_{DS}) decreases, and the threshold voltage, which corresponds to the intercept of the extrapolated drain current with the x-axis, increases in positive direction. The reason for the positive shift of the threshold voltage is mainly related to a decrease of the electron density due to the formation of radiation-induced lattice defects in the $In_{0.49}Ga_{0.51}P$ donor layer. A decrease of the effective mobility (μ_{eff}), which is thought to be due to the scattering of channel electrons with the induced lattice defects and also to the decrease of the electron density in the two dimensional electron gas (2DEG) region for the $In_{0.2}Ga_{0.8}As$ channel layers, is also observed after irradiation. The radiation source dependence on the degradation of performance is discussed taking into account the calculations of the number of knock-on atoms and the nonionizing energy loss (NIEL) with respect to the results on electron, neutron and carbon irradiation.

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GaAb & InSb RELATED MATERIALS
D-THU-06

LASING CHARACTERISTICS OF VERY SMALL OXIDE-CONFINED VERTICAL-CAVITY LASERS WITH HIGH-CONTRAST $AlGaAs/Al_xO_y$ MIRRORS, JAE-HEON SHIN(Basic Research Laboratories, ETRI, Taejon, 305-600, Korea), I.-Y. HAN, Y.-H. LEE (Dept. of Phys., KAIST, Taejon, 305-701, Korea), B.-S. YOO, and E.-H. LEE (Basic Research Laboratories, ETRI)

Recently, oxide-confined vertical-cavity lasers attract great attentions because of their low threshold currents and small cavity volumes.* The important reason to reduce cavity volume is that it enhances the coupling of spontaneous emission into a lasing mode, which would enable the zero-threshold operation via cavity quantum effect.** In this presentation, we report a photo-pumped lasing operation from a very small 3-dimensionally confined 870-nm vertical-cavity lasers with oxide aperture and high-contrast $AlGaAs/Al_xO_y$ DBR mirrors. The effective cavity length is as small as 0.37 μm, and the oxide aperture size is 0.74 μm estimated from the blue-shift of lasing mode due to the lateral confinement. The observed blue-shift of the lasing mode is 13.4 nm, the largest one ever reported for vertical cavity lasers. The optical losses seem to be size-independent for these small microlasers, possibly due to the very short cavity length and the thin oxide layer. Our results indicate the possibility of the ultimate microcavity of order of λ^3.

* D. L. Huffaker, *et al.*, *IEEE Photon. Tech. Lett.* v.8, p.974, 1996.
** T. Baba, *et al.*, *IEEE Photon. Tech. Lett.* v.9, p.878, 1997.

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D-THU-07

ELECTRICAL CURRENT EFFECT ON POLARIZATION PROPERTIES OF VERTICAL CAVITY SURFACE EMITTING LASERS, B.-S. YOO, J.H. SHIN, K.-S. HYUN, H.Y. CHU and E.-H. LEE (Basic Research Laboratories, ETRI, P.O. Box 106, Yusong, Daejon, 305-600, Korea)

Polarization properties of the optically pumped output have been investigated with applying electrical bias. Proton-implanted 850 nm top-emitting surface-emitting laser structure was used for optical pumping using an Ar^+-laser pumped Ti-Sapphire laser. For 7 μm-diameter aperture device, the optically pumped output without applying electrical bias has only small polarization selectivity. As electrical current increases, however, the optically pumped output shows the enhancement of the polarization selectivity with a linear polarization to the direction along one of [110] crystal axes. The major polarization state of the optically pumped output with applying current is same to that of the electrically pumped output. The device with a 10 μm diameter also shows similar changes of the polarization characteristics as those of the 7 μm device. These results indicate that the polarization properties are strongly affected by the applied electrical current. The polarization selectivity of the electrically pumped output is attributed to the electrical current injection. We also fabricated a surface-emitting laser with nonuniform current injection. The polarization properties of the device with varying current-injection direction will be presented.

D-THU-08

GROWTH OF $Ga_xIn_{1-x}Sb$ THIN FILMS

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Abstract

The bulk crystal growth of $Ga_xIn_{1-x}Sb$ was carried out using Bridgmen method in a microprocessor controlled temperature furnace. Then this bulk crystal was used as a source material to grow thin film on glass substrates using thermal evaporation technique under a vacuum of $\sim 10^{-6}$ torr. The value of x was varied between 0.1 to 0.5 respectively and its corresponding value of x has been measured in the film to correlate any discrepancies between the bulk and the film. The primary electrical and optical characterization *viz* resistivity, mobility, carrier concentration and band gap etc. is being carried out and will be reported in this paper.