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GROWTH AND STRUCTURAL CHARACTERIZATION OF TELLURIUM DOPED GaInAsSb QUATERNARY ALLOYS

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High-resolution X-ray diffractometry (HRXRD), Raman scattering and Far-infrared reflectance techniques were used to study the structural parameters as layer thickness, composition and lattice vibrations in quaternary GaInAsSb epitaxial layers. These epilayers were grown by the liquid phase epitaxy method. HRXRD rocking curves show the presence of these quaternary alloys on the GaSb substrate and the position of the alloy diffraction peak served to estimate the composition and lattice parameters. Raman results show prominent features associated to first-order scattering from GaSb-like and GaAs-like modes. It is observed a shift to high frequencies of these two modes as the concentration of Tellurium increases, suggesting a comprehensive effect in the GaAs and GaSb bonds due to the incorporation of such dopant. Far-infrared reflectance was measured at room temperature for these series of doped samples and the behavior mentioned of lattice vibrations was confirmed.

Keywords: QUATERNARY EPILAYERS, RAMAN SCATTERING, FAR-INFRARED REFLECTANCE.

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ATOMIC STRUCTURE OF THE BURIED OXIDE LAYER IN SIMOX WAFERS

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We found an ordered structure in the buried oxide layer of SIMOX (separation by implanted oxygen) wafers by using X-ray diffraction technique. The SIMOX wafer is one of the most promising SOI wafers, which has a buried oxide layer between the top Si layer and the Si substrate. The buried oxide layer is made by O^+ ion implantation at a dose of 10^{17}-10^{18}/cm^2 and subsequent annealing at about 1350°C. In this paper we show the x-ray diffraction patterns from SIMOX wafers, which indicates the existence of the ordered structure in buried oxide layers with an epitaxial relationship with the Si substrate. In the X-ray diffraction patterns from the SIMOX wafers we clearly observed the extra diffraction streaks at half-integer positions in reciprocal space of the Si index, such as 0.5 0.5 L (L = 0.6-1.6), 1.5 1.5 L (L = 0.3-1.6), and 1.5 0.5 L (L = 0.3-1.5). The streaks were observed for the sample where the top Si layer was removed, but disappeared when the buried oxide layer was etched off. These results obviously indicate the existence of an ordered structure in the buried oxide layer of the SIMOX wafer. From the distribution of the extra streaks we can expect the existence of laterally ordered structure of 2x2. The growth of epitaxially ordered SiO_2 in oxygen-implanted silicon during thermal annealing was also investigated. From the results it was found that the small SiO_2 precipitate itself has the ordered structure [1].
Reference
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CRYSTALLOCHEMICAL MODEL OF ALTERNATIVE SUBSTRATES FOR EPITAXIAL GROWTH OF GaN THIN FILMS

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GaN III-V nitride is a well-known semiconductor for short-wavelength light-emitting diodes with a direct band gap of 3.4 eV. But the lack of suitable substrates with low dislocation density remains some problems to development of high-performance optoelectronic devices based on III-nitride multilayers structures. The device characteristics of thin films have a large dependence on the substrate material because heteroepitaxial film becomes dominated by extended defects arising, first of all, from the interfacial mismatch. Here, for this reason, some attempts were made to solve this problem. Over fifty various inorganic crystals and their solid solutions have been considered in search for a replacement substrate. First of all, the structural data were analyzed for oxides, silicates, borates, molybdates, tungstates, tantalates. This analysis was based on the existing structural and physico-chemical database for inorganic oxide compounds, which was up-to-dated using the data from scientific journals. Among them, the main attention was paid to candidates from the viewpoint of phase stability, easy of growth and their physico-chemical properties. The epitaxial relations were examined for some crystallographic orientations of the GaN epicrystal and substrates like Al_2O_3, MgO, ZnO ZrO_2, $LiAlO_2$, $YAlO_3$, $LaAlO_3$, $LiGaO_2$, $LaGaO_3$, $NdGaO_3$, $KTaO_3$, $LaTa_3O_9$, $LaTa_7O_{19}$, Ca_2LaTaO_6, $SrTiO_3$, Si, SiC, perovskite-, spinel- and wurzite-type structures. As a result, a correlation between the growth conditions, compositions, homogeneity and structural characteristics of these promising materials has been found.

Keywords: GALLIUM NITRIDE; SUBSTRATE; STRUCTURE

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THE INTERFERENCE PATTERNS IN AIIIBV IMPLANTED WITH HYDROGEN

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The room temperature implantation with 146 keV, 100 keV and 60 keV protons in highly perfect GaAs and $Al_{0.43}Ga_{0.57}As$ was studied by recording of rocking curves and Bragg-case section topography. Another experiment was studying of GaAs double implanted with 146 keV and 60 keV protons to the doses of 6 x 1015 cm^{-2} and 4.2 x 1015 cm^{-2}. These two energies provide a penetration range differing by a factor 2. The rocking curves were taken in 400 reflection of 1.1 Å using a probe beam with a small diameter of 30 μm. The Bragg-case section topographs were taken with a glancing angle of 4° and large film-to-crystal distance up to 30 cm providing a good visibility of strain modulation fringes. The obtained rocking curves for single implantation could be well approximated by theoretical ones obtained approximating the strain profiles by the point defect distribution calculated with TRIM 95 program. The rocking curve for the double implantation with 146 and 60 keV protons differs very much from the curves obtained for single implantation. This curve contains a number of relatively narrow maxima of different heights. The shape of this curve was surprisingly well reproduced theoretically by numerical integration of the Takagi-Taupin equations. The strain profile assumed in this calculation was obtained by simple adding of strain profiles of single implantations. The present shape of interference fringes is probably caused by complicated beating and strongly depends on the amplitude of the strain profiles.

Keywords: AIIIBV SEMICONDUCTORS HYDROGEN IMPLANTATION X-RAY DIFFRACTION STUDIES