

VI-O Soft X-Ray, Ultraviolet, Visible and Infrared Spectroscopy of Solids and Devices

Work of soft x-ray (SX), ultraviolet (UV), visible (VIS) and Infrared (IR) spectroscopy of solids have been proceeded. These are mainly performed using synchrotron radiation (beamlines BL7B, BL8B1, BL4B, BL7A and BL1A at UVSOR), owing to the wide wavelength continuity of synchrotron radiation with no structure.

VI-O-1 Reflection Spectra of $\text{Al}_{1-x}\text{Ga}_x\text{N}$

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Visible, ultraviolet and vacuum ultraviolet reflection spectra of wurtzite $\text{Al}_{1-x}\text{Ga}_x\text{N}$ have been measured from 20 K to 300 K, and Kramers-Kronig analysis using of our results also presented. No drastic change in spectra between GaN and $\text{Al}_{0.14}\text{Ga}_{0.86}\text{N}$. The band gap as the function of temperature has been also presented in whole x range from 20 K to 300 K. They are well described by the Bose-Einstein expression. It suggests that the temperature shift of the band gap is mainly due to the electron-phonon interactions. The parameters of the Bose-Einstein expression are obtained by fitting.

VI-O-2 Characterization of GaN-Based Schottky Barrier Ultraviolet (UV) Detectors in the UV and Vacuum Ultraviolet (VUV) Region Using Synchrotron Radiation

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Characterization of GaN-based Schottky barrier ultraviolet (UV) detectors with a comb-shaped electrode using synchrotron radiation ($h\nu = 2.2\text{--}30$ eV, $\lambda = 41\text{--}563$ nm) is described. Below $h\nu = 8.0$ eV ($\lambda > 155$ nm), the detectors are available without any photo-emission of GaN and Au electrode. Under application of reverse bias, the responsivity is increased to 0.05 A/W

at ~ 0.4 V. The photocurrent is controlled by reverse bias. On the other hand, above $h\nu = 8.0$ eV ($\lambda < 155$ nm), the responsivity spectra are dominated by photo-emissions of Au and GaN. These results show that these Schottky type detectors with mesa structures are effective to detect vacuum ultraviolet (VUV)-UV light ($155 < \lambda < 360$ nm).

VI-O-3 Near K-Edge Absorption Spectra of the III-V Nitride

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The nitrogen and aluminum near K-edge absorption measurements of the wurtzite AlN, GaN and InN, and their ternary compounds (AlGaN, InGaN and InAlN) at various molar fractions have been performed using synchrotron radiation. Using the linear polarization of synchrotron radiation, absorption measurements with different incident light angle also performed. The spectral distribution of the nitrogen K absorption spectra clearly depends on both the incidence light angle and the molar fractions of the samples. That of the aluminum K absorption spectra also show the clear angle dependence, but it does not show the drastic molar dependence. The spectral shape comparisons among the various molar fractions, different incident angles and between two ion sites are discussed. The numerical component analysis of the K absorption spectra is also presented.

VI-P Optical Techniques for Synchrotron Radiation

The performance check of beamline BL7B at UVSOR and the development of a surface profiler for optical elements used in synchrotron radiation beamline have been proceeded

VI-P-1 Performance of IR-VUV Normal Incidence Monochromator Beamline at UVSOR

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The beamline BL7B at the UVSOR facility for solid-state spectroscopy has been opening for users after reconstruction. This beamline consists of a 3 m normal incidence monochromator and covers the spectral range from the vacuum ultraviolet to the infrared region. The optical configuration and the performance, such as photon number, purity and resolving power, are reported.

VI-P-2 Development of A Surface Profiler for Optical Elements

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A surface profiler for optical elements used in synchrotron radiation beamlines has been developed. By measuring the precise positions of an incident and reflected laser beam, the surface profile of mirrors and gratings can be obtained. The profile of large mirrors up to 700 mm long and that of any other shape device such as plane and non-spherical mirrors can be also measured. The design concept and preliminary examples of profile measurements are reported.