Study of Lattice Parameters of Polycrystalline Indium Nitride Crystals in the 298-613 K Temperature Range

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Thin layers formed from III-V nitrides or their solid solutions are components of optoelectronic devices. The structural data at high temperature and thermal-expansion properties of the bulk material provide a necessary basis in development of such devices. Indium nitride is one of key material for optoelectronics. Previous experimental study [1] was based on data for selected reflections using the laboratory equipment, and the resulting precision of the data was limited. In the present study, experimental high-temperature investigation of lattice parameters of InN was undertaken. The powder diffraction data were refined using the Rietveld method in the temperature range from room temperature up to 613 K, with elimination of errors coming from systematic errors and wavelength fluctuations.

Polycrystalline indium nitride studied in this work was prepared at Warsaw University of Technology from high-purity components. The measurements were carried out at a powder diffractometer at the B2 beamline. The applied instrumental parallel-beam set-up includes a Ge(111) double monochromator, and a curved on-site readable imaging plate, OBI [2]. The wavelength was calibrated *in situ*, using the internal polycrystalline-diamond standard with one micrometre crystallite size. For sample mounting, a thin-wall quartz capillary (0.3 mm in diameter) was applied. A graphite heater with rotating capillary was applied. The capillary was held at a nitrogen atmosphere.

For structure refinement, the Fullprof.2k (v. 2.70) [3] program was used. The temperature dependence of the wurtzite-type structure lattice parameters on temperature is considerably smoother than that reported in Ref. [1], and it can be used to derive reliable thermal expansion coefficient values in the studied range. Gradual decomposition of the InN sample at the end of the studied range was observed.

References

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