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Structure of AlN films deposited by magnetron sputtering method

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The AlN films on the Si substrate were synthesized by the magnetron sputtering method. The dual magnetron system [1] operating in AC mode was used in the experiment. Processes of synthesis were carried out in the atmosphere of a mixture of argon (as the source of ions sputtered the material of cathode) and nitrogen. Morphology and phase structure of the AlN films were investigated as a function of pressure of Ar/N_2 and the deposition time. Structural characterizations were performed by means of SEM and X-ray diffraction method carried out at W1.1 beamline (Hasylab/DESY). Our results show that the use of magnetron sputtering method in the dual magnetron sputtering system is an effective way to produce a thin, transparent AlN layers which are characterized by a good adhesion to the silicon substrate. The morphology of the films is strongly depend on the Ar/N_2 gas mixture pressure. Increase of the mixture pressure is accompanied by columnar growth of the layers. The films obtained at the pressure below 1 Pa are characterized by more fine and compacted structure. The thick films are characterized by hexagonal AlN structure, while the AlN thin films with the thickness less than 100 nm exhibits amorphous structure. Obtained results allow us to assume a possible mechanism of the AlN layers formation.

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XANES lattice location of cobalt implanted into monocrystalline ZnO and plasma pulse annealed

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Energy pulse annealing associated with transient melting and crystallization of implanted surface layer is considered as an effective method of implantation damage removal and impurity solubility enhancement[1]. To examine applicability of this method to manufacture of diluted magnetic semiconductors (DMS) we implanted monocrystalline ZnO with cobalt to a dose of 10^{16} ions/cm^2. Next the samples were either thermally annealed at 800°C in argon or treated with high energy plasma pulses of an energy density in the range of 1 – 1.5 J/cm^2. The location of cobalt atoms in the lattice was studied by X-ray absorption near edge spectroscopy (XANES) using ELETTRA synchrotron radiation. An analyses of the obtained XANES spectra reveals absence of Co precipitates and an important difference between the Co spectrum obtained after 1.5 J/cm^2 treatment and the remaining spectra . The results are analyzed in terms of Co atoms positioned substitutionally in ZnO after pulse melting and crystallization.

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