PR12.02.20 EPITAXIAL WATER FILM STRUCTURE ON THE MICA CRYSTAL SURFACE. Metsik, M. S., Kiselev, A. B., Shcherbachenko, L. A., University of Irkutsk, Russia

The Structure model of the water film which is on the surfase of mica crystals has been made and a research of diffraction of low intensity X-radiation in water film with the change of film thickness has been done.

It was found that water film structure is initiated by the net of oxygenous hexagonal rings belonging to the silicon oxigenous tetrahedrons of mica crystal lattice. Due to the geometry of this "drawing" water molecules are fixed by hydrogen bond and form a layer net stretching epitaxially into the depth of the film. The distance between water molecules is 2,6 A which is equal to the distance between oxygen atoms in silicon oxigenous tetrahedrons on the crystal surfase. The next two coordination spheres have radiuses 4.2 and 5.1 A. These theoretical calculation are confirmed by the water film low intensity X-raying.

The appearence of tetrahedron quartz-like structure on the juvenile surfaces was noticed for water films with the thickness of 10-50 mkm. Sphere radiuses of this structure are 2.6; 4.2; 5.0 A. The film structure changes due to the mica surfase field attenuation and phonon influence increase during the time.

So, it was found that the water film structure is realised by hexagonal oxigen rings of silicon-oxygenous tetrahedrons of the mica crystal lattice and looks like a tetrahedron quartz-like package of water molecules and differs from ice structure as well as from volume water sructure.

PS12.02.21 INTERFACIAL ROUGHNESS IN (111)-ORIENTED $Si/Si_{1-x}Ge_x$ MULTILAYERS. J.H. Li, Y. Yamaguchi, P. M. Reimer, O. Sakata, and H. Hashizume, Tokyo Institute of Technology

Interfacial roughness of semiconductor heteroepitaxial structures has been a subject of extensive studies in recent years, driven by the thought that the interfacial roughness might become a crucial limit for high carrier mobility when the quantum well is down-sized to nanometer scales. Characterization of the nature of the interfacial roughness is important both for understanding the physical mechanism involved in roughening and for controlling it. X-ray reflectivity and diffuse scattering measurements are powerful techniques for such studies, due to its high sensitivity to a wide range of length scales (say, from atomic to micrometer order), and its non-destructive nature. Among the previous studies, (001)-oriented $Si/Si_{1-x}Ge_x$ multilayers have received a great attention because its potential applications in infrared detectors and high-speed field-effect transisitors. In this work, x-ray specular reflectivity and diffuse scattering, combined with high-angle Bragg diffraction, were employed to study the interfacial properties of (111)-oriented $Si/Si_{1-x}Ge_x$ multilayers. The samples contain 10 pairs of $Si/Si_{1-x}Ge_x$ layers with a nominal periodicity of 10nm (5nm for each of the two component layers), and x of either 0.1 or 0.3. Interfaces are characterized by a quasi-periodically undulated morphology, which is believed to be originated from the terraced surfaces of the substrates due to an unintentional miscut. Our x-ray results have been compared to atomic force microscopy measurements.

PS12.02.22 STRUCTURE OF INDIUM NITRIDE THIN FILMS PREPARED BY RF-MAGNETRON SPUTTERING. Y. Nakane, Department of General Education, Hokkaido Polytechnic College, Zenibako 3-190, Otaru 047-02, Japan.

The processing conditions for thin films of indium nitride using reactive rf-magnetron sputtering method are investigated by means of X-ray diffraction and Auger electron spectroscopy. The films were prepared by the method with an indium metal target and a mixture of Ar and N_2 gases at 10^{-3} torr. Silicon wafers and plates of silica glass were used as the substrates. In the processing, the substrates were electrically heated at temperatures between room temperature and 673 K. Thickness of the films was controlled to be 1000 A and 2000 A by changing sputtering time. The composition of the films was measured by means of Auger electron spectroscopy. The X-ray diffraction patterns were measured in order to evaluate the crystallinity. The patterns from the film prepared at room temperature showed strong and broad intensities with weak and sharp peaks. It means that the film is composed of amorphous and crystalline phases and the greater part of the film is amorphous. The crystal structure of the crystalline phase estimated from the reflections, however, was essentially different from the hexagonal structure which is generally observed in the bulk system. The volume ratio of amorphous to crystalline phases strongly depended on nitrogen partial pressure of the mixture and temperature of the substrate. In the presentation, the relationship between the crystallinity and the processing conditions will be discussed based on electronic bonding states of the films measured by X-ray photoelectron spectroscopy and by Fourier transformed infrared resonance.

PS12.02.23 STRUCTURE OF AUSTENITIC Fe-Ni ALLOYS SURFACE AFTER LASER HEATING. A.V. Nedolya, Faculty of Physics, Zaporizhya State University, 66 Zhukovsky Str., 330600 Zaporizhya, Ukraine

Fe—Ni alloys after laser heating were investigated by X-ray powder diffraction and scanning electron microscopy. As a result it was found that microstructure of alloys was reduced to fragments by laser pulse treatment. Lattice parameter value of solid solution showed abnormally high carbon content at some laser treatment conditions. X-ray investigations of laser heating thin surface layers showed irregular carbon distribution and other alloying elements throughout the treated layer. The research of thin surface layer showed nonmonotonous dependence of austenite lattice parameter deep into treated layer. The carbon concentration in austenite of these laser-heated zones was more than its concentration after hardening in water and as a result, the lattice parameter of austenite increased.

PS12.02.24 EFFECTS OF ANISOTROPY AND GYROTROPY OF CRYSTAL FILM ON CHARACTERISTICS OF POLARIZED LIGHT. B.V. Nabatov, A.F. Konstantinova and A.Yu. Tronin. Institute of Crystallography, Russian Academy of Sciences, Leninsky pr. 59, Moscow 117333, Russia.

Reflection of light from the gyrotropic uniaxial film with arbitrary axis orientation accounting for repeated reflection is investigated. This problem is considered by using the covariant method for an oblique incidence of light, for different refractive indices of ambient and substrate and it is solved numerically. As a result diagonal and off-diagonal components of the reflectance and transmitance matrices, ellipticities and azimuths of reflected and transmitted light are calculated.

Dependences of the reflection coefficients as a function of the incidence angle, wavelength, the orientation of the optical axis, refractive indices and gyration tenser components are discussed. The gyrotropy manifestation in anisotropic films such as changing the symmetry of the system, appearance of off-diagonal reflection coefficients in symmetrical optical orientations, increase of reflected light ellipticity upon approach of the ambient refractivity to that of the film and etc. are analyzed. The use of such characteristic dependences makes possible the experimental determination of gyrotropy with reflected light.