study of the growth of the layers of Hydroxyapatite obtained by PLD.

Keywords: laser ablation, thin films, hydroxyapatite

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Strain-mediated Phase Coexistence at Phase Transitions in Epitaxial Films

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We show that the first-order structural phase transitions in heteroepitaxial films proceed in a way qualitatively different from the same transitions in bulk crystals. Instead of an abrupt transition with a temperature hysteresis inherent to the first-order transition in bulk crystals, the two phases coexist in the film in a large temperature interval with the fraction of the low-temperature phase linearly increasing on cooling and linearly decreasing on heating. The phase coexistence is explained by the restriction on lateral expansion of the film imposed by the substrate. The coexistence is a result of the balance between the free energy released at the phase transformation and the emerging elastic energy.

We study the MnAs epitaxial films on GaAs(001) and (111) and find the phase coexistence in the temperature interval as large as 20°C. We obtain, in detailed x-ray diffraction studies [1-5], the phase fractions, the domain sizes, and their periodicity in the whole coexistence range. We demonstrate, by comparing the observed domain structure with the energy-minimizing one, that the film is close to the equilibrium. We reveal the periodic surface corrugations due to difference in lattice spacings of the two phases.

[1] Kaganer V.M., et al., *Phys. Rev. Lett.*, 2000, **85**, 341. [2] Kaganer V.M., et al., *Phys. Rev. B*, 2002, **66**, 045305. [3] Plake T., et al., *Appl. Phys. Lett.*, 2002, **80**, 2523. [4] Jenichen B, et al., *Phys. Rev. B*, 2003, **68**, 132301. [5] Jenichen B., et al., *Z. Kristallogr.*, 2004, **219**, 201.

Keywords: phase transitions, phase equilibria, epitaxial layers

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Structural Properties of Ferromagnetic GaMnAs Layers

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Thin layers of ferromagnetic GaMnAs, prepared by MBE under various conditions, were examined by X-ray diffraction and reflection. Preparation of samples was performed by low temperature (LT) growth (200-250°C) using both As_4 and As_2 molecular beams at various As/Ga ratios. Subsequently, samples were annealed in order to optimize their transport properties and to enhance their Curie temperature.

To determine the structural parameters high resolution X-ray diffraction measurements and reciprocal space mapping close to the symmetrical (002), (004) and asymmetrical (224) Bragg reflections as well as specular and diffuse scattering measurements close to the (000) reflection were performed. The combination of different X-ray scattering techniques allows more complete characterization of the samples.

Structural and compositional parameters of the samples (strain, lattice constant, Mn concentration, As nonstoichiometry, defects, inhomogeneity) were evaluated and discussed in relation with their galvanomagnetic properties and preparation conditions.

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Keywords: magnetic semiconductors, high resolution X-ray diffraction, epitaxial thin layers

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Estimation of Lattice Structure of Strained-Si Wafers Using Highly Parallel X-ray Microbeam (I)

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We demonstrate the estimation of lattice structure of commercially available strained-Si wafers by high-resolution X-ray diffractometry using a highly parallel X-ray microbeam [1].

A strained-Si wafer has 3 layers of strained-Si, constant composition of SiGe (CC) and graded composition of SiGe being epitaxially grown on a [001]-oriented Si substrate. The thicknesses of these layers are 17.5 nm, 3.2ìm and 2.4 ìm, respectively.

Diffracted X-rays from extremely thin strained-Si layer could be detected by use of the X-ray microbeam. The intensity distribution maps in reciprocal lattice space show that the lattices in strained-Si, and CC layers are greatly misarranged to the Si substrate. However, the equi-tilt maps, which are intensity distribution measured under fixed rotation angles of the sample and an analyzer crystal, reveal that the lattice tilt variation of these layers is not random but roughly aligned in mainly its crystallographic orientation parallel to one of the two <110> directions. Furthermore, it would be considered that the crystallographic orientation of lattices in the strained-Si layer matches to that of the underlying CC layer.

[1] Matsui J., et al., *proceeding of the 4th international symposium on advanced science and technology of Si Materials*, 2004, 237.

Keywords: silicon technology, synchrotron X-ray diffraction, X-ray microanalysis of thin specimens

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Estimation of Lattice Structure of Strained-Si Wafers Using Highly Parallel X-ray Microbeam (II)

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Strained-Si (s-Si) wafers are expected as the next generation high-speed electronic devices. In order to estimate the crystallinity of s-Si wafers, we developed a high flux X-ray microbeam with a small angular divergence and a narrow energy bandwidth. The X-ray microbeam is formed at SPring-8 by combining the Si single crystals and an X-ray mirror.

We estimated two commercially available s-Si wafers. One is a s-Si/SiGe/Si wafer and the other is a s-Si/SiO2/Si wafer. The thicknesses of s-Si layers of two samples are 17 nm and 15 nm, respectively. The high flux X-ray microbeam enable us to obtain the reciprocal lattice maps of these extremely thin s-Si layers.

The intensity distributions in reciprocal lattice space maps reveal that the lattice parameters of s-Si layers are almost the same as expected values. However, the crystallographic directions normal to s-Si lattice planes greatly distribute about 500 micro radian.

[1] Matsui J., et al., *proceeding of the 4th international symposium on advanced science and technology of Si Materials*, 2004, 237.

Keywords: silicon technology, synchrotron X-ray diffraction, X-ray microanalysis of thin specimens

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Study of Te Diffusion into Structure GaSb-n/GaSb-p on GaSb-n Substrate

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The study of the influence about Te diffusion in structural properties of thin layers GaSb-p with the high resolution X-ray