units of strongly coupled spins, whose relative orientation can vary easily involving noncollinearity of the spins. In a second example, an antiferromagnetic NiO/CoO thin layer over Pt, it was demonstrated that the soft-x-ray resonant magnetic reflectivity measured over a wide angular range provides a direct way to probe out-of-plane magnetic profiles [2]. Tonnerre *et al.* obtained the extension and structure of the magnetic ordering induced by an ultrathin Co FM layer, over a few oxide atomic layers in the antiferromagnetic layer.

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Keywords: X-ray_resonant_magnetic_scattering, interfacial_magnetism, metallic_thin_films

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High energy X-Ray surface and interface scattering

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Using a focused high energy x-ray beam (E < 100 keV) we have developed a dedicated instrument for High Energy MicroDiffraction (HEMD) for surface and interface scattering at beamline ID15A (ESRF, Grenoble, France). The high energy of the beam allows us to access deeply buried structures including interfaces. The instrument is also equipped with a beam deflector unit which allows us to incline the x-ray beam with respect to flat liquid surface and interfaces, sufficient to reach large perpendicular momentum transfer for atomic or molecular resolution [1].

The instrument has been used for a wide range of structural investigations on deeply buried interfaces. Examples including such diverse materials as ice, ionic liquids, alcohols, metal- semiconductor/insulator interfaces, hydrophobic interfaces, will be presented in order to demonstrate the high performance and capabilities of high energy microbeams in structural investigations of buried interfaces.

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Keywords: surface, interface, high-energy x-rays

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High resolution STEM study of InGaAs/InAlAs and Si/Ge heterostructures

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Si/Ge and InGaAs/InAlAs based heterostructures are studied as perspective materials for high frequency generators, detectors and optoelectronic devices. Two types of heterostructures were investigated: a) $In_xAl_{1-x}As/In_yGa_{1-y}As/In_xAl_{1-x}As$ on InP substrate with different layer thickness and different content; b) Si/Ge heterostructures having 2 to 12 Ge layers thickness and deposited at low temperatures. The heterostructures were formed by MBE. In the present study we show an application of high-resolution scanning/transmission electron microscopy for the determination of structural parameters and defects in heterostructures. The Cs corrected TITAN 80-300 TEM/STEM (FEI, US) equipped with HAADF detector (Fischione), EDXS (EDAX, US) and GIF (Gatan, US) systems were used in the study. In both systems the interfaces were atomically flat and tetragonal lattice distortions was the most typical mechanism of crystal lattices mismatch reduction. Low density of 60^0 misfit dislocations, microtwins (MTs), stacking faults (SFs) and second phase precipitates were found at $In_xAl_{1-x}As/In_yGa_{1-y}As$ interfaces Fig.1. These precipitates were identificate as wurtzite inclusions in sphalerite matrix. The inverted piramids started to form in the Ge layers associated with SFs, when thickness exeeded 10 monolayers. The MT and SF were revealed mostly by bright field HREM demonstrating poor contrast in HAADF STEM mode. The structure-properties relations were discussed.

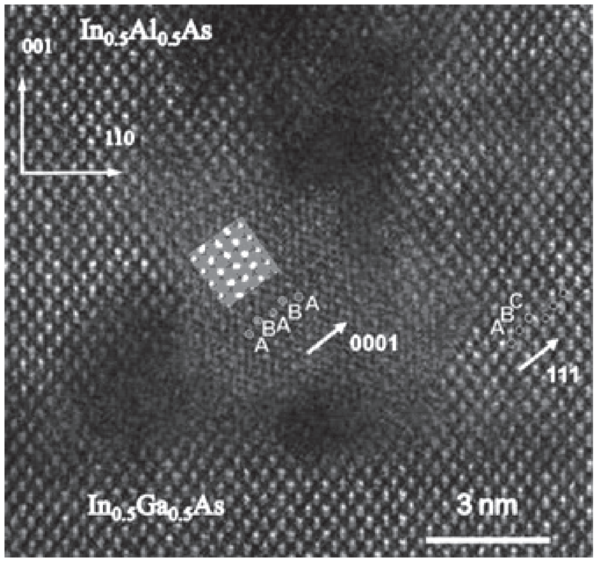

Fig. 1. HR STEM image of $In_{0.5}Al_{0.5}As/In_{0.5}Ga_{0.5}As$ interface. The model of wurtzite structure is in the insert. The sequence of layers typical for wurtzite (ABABAB) and sphalerite structures (ABCABC) are shown.

Keywords: heterostructures, STEM, defects.

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Spatial resolution of electronic structure through modeling reflectivity spectra

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X-ray absorption spectroscopy has become an important tool in understanding the electronic structure of materials. Resonant absorption edges in the soft x-ray regime are especially interesting as they allow the study of the lighter elements, such as in organic or organo-metallic substances, as well as important *L*-edges of the 3*d* transition metals important in magnetic and oxide systems. Measurements of soft x-ray absorption spectra are inherently surface sensitive, and are plagued by issues such as extinction (in electron yield measurements) or self absorption (in fluorescence yield measurements), which make accurate determination of the optical constants difficult. More accurate optical constants can be obtained by modeling the reflectivity spectra, while being somewhat less surface sensitive compared to electron yield.

Soft x-ray reflectivity from single crystals, thin films, or superlattice structures contains depth dependent information that can be exploited