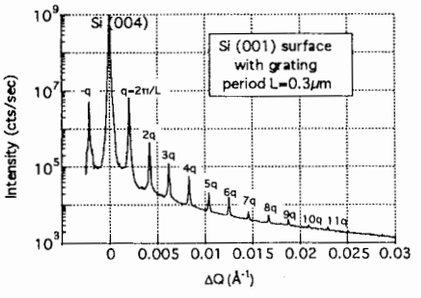
coordinated sites between the Cu rows. Three-fold coordinated sites like on H/Ni(110)-(2x1) can be excluded. Oxygen forms two different ordered structures, (2x1) and c(6x2) at coverages of 0.5 amd 0.66 (ML). These structures are surface compounds consisting of Cu-O chains adsorbed on the slightly relaxed but otherwise unreconstructed surface. In the case of the c(6x2) structure the Cu-O chains are kept together by additional top Cu atoms. The results of the LEED structure analysis compare well with the X-ray results [1]. The beam profile analysis shows that the mechanism of the superstructure formation is different from that after H adsorption though both structures involve mass transport of half a substrate layer. The formation of the (1x2) missing row structure involves the movement of steps and probably starts at steps. The formation of the O-Cu chains, on the other side, starts at terrace sites, as has been shown previously by STM measurements [2] and causes at higher temperatures the creation of defects on flat terraces.
Sulfur, which is slightly weaker bound to Cu than oxygen forms 5 different ordered structures. With increasing coverage c(2x10), p(2x5), p(5x2), c(8x2) and p(3x2) structures occur. LEED I/V analyses have been performed for 3 structures, p(2x5), p(5x2) and c(8x2). The results are compared with recent STM measurements [2].

[1] R.Feidenhans'l, F.Grey, M.Nielsen, F.Besenbacher, F.Jensen, E.Laesgaard, I.Stensgaard, K.W.Jacobsen, I.K.Norskov and R.L.Johnson, Phys.Rev.Letters 65 (1990) 2027.
[2] F.Besenbacher, L.Stensgaard, L.Ruan, J.K.Norskov and K.W.Jacobsen, Surf. Sci. 272, (1992) 334.

PS-11.01.11 X-RAY SCATTERING FROM COHERENT PERIODIC GRATING STRUCTURES ON SEMICONDUCTOR SURFACES. By Qun Shen*, CHESS, Cornell University, and C.C. Umbach and J.M. Blakely, Dept. of Materials Science & Engineering, Cornell University, Ithaca, New York 14853, U.S.A.



We have performed a high resolution x-ray diffraction experiment on a Si (001) sample with surface gratings in both the [110] and the [1,-1,0] directions, using synchrotron radiation at CHESS. More than ten orders of grating interference reflections arising from a 0.3 μm grating period have been observed (see Figure above). The widths of these grating peaks are as narrow as that of a crystal reflection, despite of only ~20 gratings probed within the coherent width of the x-rays. This demonstrates that every atom at lattice site within a single crystal domain scatters coherently and contributes to the superlattice reflections. The intensity distribution among these grating superlattice reflections provide valuable information on the shape and the structure of the surface gratings as well as on possible crystal lattice distortions. With a transverse coherent length of 5-10 μm and a wavelength of ~1Å, x-rays are perfectly suited both for analyzing submicron-sized grating structures and for determining crystallographic qualities of the grating material.

PS-11.01.12 PREPARATION OF THIN TRANSITION METAL ALLOY FILMS BY SUCCESSIVE VACUUM DEPOSITION AND THEIR STRUCTURE INVESTIGATION BY HREM. By K. Yoshida, R. Yamashita, T. Kawai and K. Shimonishi, Faculty of Engineering, Kobe University, Rokkodai, Nada, Kobe 657 Japan.

Intermetallic compounds with lattice dimensions larger than 10 Å are frequently found in many binary transition metal alloys. Some of them are industrially important as in powdering phenomenon during plastic deformation and pin-hole formation in protective surface coatings. The larger are the lattice constants, the more are they suited to the high resolution electron microscopy because of its limited resolving power. Thin, enough for the observations, alloy films can be prepared by a low temperature heating of double layer thin films which are prepared by successive vacuum deposition. Results at the present for the alloy films of Mn-Bi and of Fe-Zn system will be shown.

Bi was deposited about 300 Å thick on Carbon supporting films of 100 Å thickness. Mn was then deposited onto top surface of the Bi layer 200 Å in thickness. Degree of the vacuum during these depositions was on the order of 10^{-6} Torr. The double layer films were then heated at 265°C, just below the melting point of Bi, 271°C, in the same vacuum for 50 to 200 hr. Thickness of thus prepared alloy films is less than 500 Å and they can directly be observed under an electron microscope. More than four different kinds of new crystals were found in the specimens (K. Yoshida et al, Suppl. to Trans. JIM, 1988, 29, 135-138), whereas only one intermetallic compound, MnBi phase, is described to exist in the published phase diagram. The most remarkable one of the new alloys is the so-called long-period tetragonal phase, whose lattice constants are as long as a=17.26 Å, c=10.21 Å. Symmetry and the lattice constants were determined only from its single crystalline net electron diffraction patterns (K. Yoshida et al Acta Cryst., 1989, B45, 40-45). At the first sight, its high resolution images are very similar to those of Sigma-phase of Ni-Cr alloy system. However, there is a clear discrepancy between this new Mn-Bi alloy phase and the Sigma-phase structure in the extinction of the diffraction spots. Structure of this new phase must then be a deviated one from the regular Sigma-phase structure. Correct positions of almost 60 atoms in the large unit cell are now being searched for referring both to its high resolution images and to its diffraction spot intensities. Some quasicrystalline regions of twelve-fold symmetry, preferably interpreted as an aggregate of atomic clusters,16 Å in diameter, were occationally found in the specimens (K. Yoshida et al, Phil. Mag. Lett.1991, 63, 127-132). This region will be a preliminary stage to the full establishement of the long-period tetragonal lattice.

In the case of Fe-Zn alloy films, Zn is very easy to evaporate. Therefore, Zn was deposited much thicker, 800 Å, on top of the Fe layer whose thickness was about 200 Å. The double layer films were then heated at 150°C in the vacuum for 150 hr. The melting point of Zn is 419.5°C. Small Fe grains seemed to extend somewhat by this heating and selected area diffraction patterns from different grains showed that Capital Gamma-phase (Γ-phase) was formed in the specimen. This alloy has a cubic lattice with a=8.98 Å and atomic positions in the lattice were postulated by a few precedent investigators. Their results are now being re-examined by comparing their computer simulated images with the obseved high resolution ones as well as the diffraction spot intensities. Many high resolution images showing various types of lattice defects were also taken, which may have some correlation to the powdering phenomenon of industrical galvanized steels.

Finally, it can be said that the preparation procedure described above will be best suited to structure investigations using high resolution electron micrographs together with the electron diffraction patterns.

