05.1-1 THE INITIAL INTERACTION OF OXYGEN WITH THE NICKEL(110) SURFACE - A SCANNING TUNNELING MICROSCOPY (STM) INVESTIGATION. By E. Ritter, J. Wintterlin*, R.J. Behm*, Institut für Kristallographie, Universität München, BRD,* Fritz Haber-Institut der MPG, Berlin.

STM topographic images scanned during adsorption show both the evolution of the 2x1/3x1 chemisorbed structures and the formation of ordered (9x4) and disordered surface oxide. Either reaction involves the rearrangement and transport of substrate atoms. The dependence of material transport within the first surface layer on temperature and on the concentration of defects is demonstrated. At T > 400 K, the evolution of the 2x1 phase proceeds via the formation and growth of reconstructed and partially disordered areas. Their average size is approximately given by the mean distance between surface inhomogeneities. With a very low defect concentration, terraces of about 1000 Å width are found to be stable even within the chemisorption stage. Beyond a critical coverage, however, considerable parts of first layer atoms start to diffuse over large (100 to 1000 Å) distances and a surface is obtained that consists of steps and terraces. The 3x1 and the 9x4 phases have been imaged with atomic resolution.

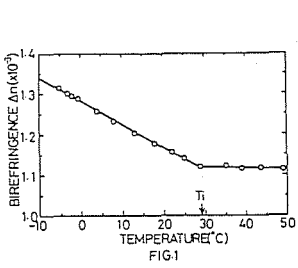

FIG.1

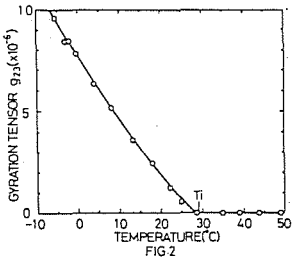

FIG.2

Table.1

substances	Δn	g
$(NH_4)_2BeF_4$	9.3×10^{-3}	5.6×10^{-6}
$[N(CH_3)_4]_2ZnCl_4$	7.5×10^{-5}	2.8×10^{-7}
$[N(CH_3)_4]_2CuCl_4$	3.3×10^{-2}	1.7×10^{-5}
Rb_2ZnCl_4	1.3×10^{-3}	8.8×10^{-6}

05.1-2 OPTICAL ACTIVITY OF THE INCOMMENSURATE PHASE OF Rb_2ZnCl_4. By K.Saito and J.Kobayashi, Department of Applied Physics, Waseda University, Japan

HAUP, a new optical method (J.Kobayashi and Y.Uesu, J.Appl.Cryst.,1983,16,204-211), has enabled one to measure the optical activity of crystals belonging to all the crystal classes. As data were accumulated it was revealed that in fixing the crossed Nicols positions another systematic error must invariably be introduced caused by the parasitic ellipticities of the polarizer and analyzer and the refraction of the light beam by the specimen. A method has been derived by which this systematic error can be removed from the original HAUP method (J.Kobayashi, H.Kumomi and K.Saito, J.Appl. Cryst.,1986,19,377-381). The improved method has been successfully applied to the measurement of the temperature dependences of the optical activity of $[N(CH_3)_4]_2ZnCl_4$(J.Kobayashi and K.Saito, Proc.Japan Acad.,1986,62B,177-179) $[N(CH_3)_4]_2CuCl_4$ and $(NH_4)_2BeF_4$. It has been found that they display optical activity in their incommensurate phases. Here, we report the result of measurement of optical activity in the incommensurate phase of Rb_2ZnCl_4, where the light beam travels along a direction rotated by $\pi/4$ from the b and c axes. Fig.1 and Fig.2 represent the temperature dependences of birefringence and a gyration tensor component g_{23} respectively. g_{23} linearly increases with decreasing temperature from Ti in the higher temperature region of the incommensurate phase. The value of g_{23} at -5°C is compared with the peak values of the incommensurate phases of the above-mentioned crystals in Table.1.

05.1-3 PRESSURE-INDUCED PHASE TRANSITION IN As. By T. Kikegawa and H. Iwasaki, Photon Factory, National Laboratory for High Energy Physics, Oho, Ibaraki 305, Japan.

While the existence of several high-pressure phases has been reported for the Group Vb elements, P, Sb and Bi, any indication of pressure-induced structural transitions, based on in-situ measurements, has not hitherto been found for As. Extending considerably the pressure range attainable, we have carried out X-ray and synchrotron radiation diffraction study on this element and found a new phase transition.

Diamond-anvil cell was used with paraffin oil as pressure transmitting medium and ruby tips as pressure sensor. The sample temperature was kept not only at room temperature but also at 200°C or higher. The heating could reveal the occurrence of structural changes which might had been suppressed owing to insufficient atom mobility at the lower temperature. The A7-type structure characteristic of the Group Vb elements, however, remains stable up to a pressure as high as 30 GPa with the rhombohedral distortion of the lattice decreasing continuously. At 32 GPa, a change in the diffraction pattern was observed and the reflexions were indexed interms of the primitive simple cubic structure, which is stable upon further compression up to at least 41 GPa. The volume discontinuity at the transition is very small as observed for P.

The observed transition in As is in an agreement with a theoretical prediction by Mattheiss et al.(Phys. Rev. 1986, B30, 2190-8) based on a total energy calculation. Discussion is given on a general trend in the structure sequence of the Group Vb elements under high pressure.