07.2-15 X-RAY STUDIES OF ARTIFICIAL SUPERLATTICES GROWN BY MOLECULAR BEAM EPITAXY. By H. Terauchi, K. Kamigaki and H. Sakashita, Department of Physics, Kwansei-Gakuin University, Nishinomiya 662, Japan.

There have been many structural studies of one-dimensional superlattices grown by the molecular beam epitaxial (MBE) method (H. Terauchi et al., J.Phys.Soc.Jpn., 1985, 54, 4576-4585;Surface Science, 1986, 174, 592-597). Alternating monolayer growth of GaAs and AlAs has been confirmed by detecting the reflections at Brillouin zone boundaries in the reciprocal space. In strained GaAs-InAs superlattices the tetragonal distortion is found and the tetragonality increases with decreasing thickness of the GaAs layer. Terraced superlattices have been also confirmed by x-ray diffraction. The x-ray study of the interdiffusion in the superlattice will be discussed at the Congress.

Recently, Merlin et al. (Phys.Rev.Lett., 1985, 55, 1768-1770;1986, 57, 1157-1160) have reported the first realization of a quasiperiodic superlattice, where the ratio of alternating layers of GaAs and AlAs forms a Fibonacci sequence. They found some of the unique properties of the novel structure. Here we report the first realization of a configurational Fibonacci superlattice grown by MBE, where the ratio of alternating layers of GaAs and AlAs is the same. The self-similarity of our crystals will be discussed. The synchrotron x-ray studies of our crystals will be also reported at the Congress.

The authors wish to express their thanks to N. Sano, H. Kato, M. Nakayama, H. Iwasaki, T. Matsushita, J. Harada, Y. Kashihara, N. Kashiwagura, Y. Fujii, Y. Noda and Y. Yamada for their fruitful discussion. The work has been supported by the Yamada Science Foundation.

07.2-16 HIGH RESOLUTION UHV-ELECTRON MICROSCOPY OF GOLD ATOMIC CLUSTERS. By K.Takayanagi, Y.Tanishiro, K.Akiyama, K.Kobayashi and K.Yagi, Tokyo Institute of Physics, Physics Department, Oh-okayama, Meguro, Tokyo, 152 Japan.

Small clusters draw much attention because of their specific structures and physical properties. Electron microscope observations of them have been limited to sizes of 10 - 100 nm, except recent one by Iijima. We have recently succeeded to reveal structural change of gold atomic clusters growing on a graphitized carbon using a new high resolution UHV electron microscope designed for in-situ study at 10^{-10} Torr level(K.Takayanagi et al.,Proc. XIth ICEM, Kyoto,1986,p.1337). Profile images were recorded on VTR and reproduced on a 16 mm cinefilm. We recognized dark dots, images of a single atom or a few atoms in a row, hopped about on the substrate initially. A cluster consisting of a few to of several tens of atoms grew subsequently. Dark dots in the cluster rearranged during the growth, indicating high mobility of atoms in such an atomic cluster. Multiply twinned particles are known as stable configuration of atomic clusters. From arrangements of the dark dots in clusters, the icosahedral particle consisting of 55 atoms was recognized. In atomic clusters with a smaller number of atoms, arrangements of dark dots indicate specific atomic configurations. The present observation thus demonstrated structure of atomic clusters which have never been seen directly. To determine their configuration, low temperature experiments is needed to suppress the high mobility of atoms due to thermal excitation, although electron beam excitation has also to be reduced.

07.2-17 FIM INVESTIGATIONS OF ORIENTATION RELATIONS AT THE HEAT TREATED B/W INTERFACES. By A. Nakamura, S. Koike, M. Tagawa, N. Ohmae and M. Umeno, Department of Precision Engineering, Osaka University, Suita, Japan.

The core tungsten filaments of boron fibers change into some types of borides such as W_2B_5 and WB_4 during the CVD process. The W-boride formation at the B/W interface is of technological and industrial importance. Processes of W-boride formation have been studied using field ion microscope (FIM) by sputter depositting B films on to W tips and by heating the tips at varied temperatures. Stable WB and W_2B_5 were found at heating temperatures of near 1100K and over 1200K, respectively. Epitaxial relations in the formation of W-borides have been recognized; i.e., WB{001}// W{001} and W_2B_5{0001}// W{011}. This has been explained by the misfits between the locations of W atoms in bulk W and of those in borides. Characteristics in the He-ion image of W_2B_5 obtained in this study showed a resemblance to that previously observed at the core of boron fibers. TEM observations of the core of the boron fibers revealed that the W_2B_5(0001) deflects from the tip axis at 60° and sometimes at 40°. Therefore it is concluded that the growth of W_2B_5 in boron fibers initiate on the {011} plane which has an angle of 60° from the central (011) plane.

07.2-18 AN X-RAY FOURIER LINE SHAPE ANALYSIS OF HEXAGONAL TELLURIUM FILMS : INFLUENCES OF SUBSTRATES AND TEMPERATURES. By Ela Chatterjee and S. P. Sen Gupta, Department of Materials Science, Indian Association for the Cultivation of Science, Jadavpur, Calcutta - 700 032, India.

The present investigation reports a detailed study of the growth structures, based on an X-ray Fourier line shape analysis of the microstructural parameters, of tellurium films deposited onto different substrates namely,glass,air-cleaved mica and single crystals of NaCl and KBr, in the temperature range of 298K-423K and at normal and oblique vapour incidences of 26.2° and 44.2°. The film thicknesses are in the range from 150-5900nm on glass and mica substrates and from 60-650nm on the alkali halide single crystals. Post-deposition annealing at 353K and 423K after deposition at 298K (room temperature) was also carried out on a few films on glass and mica. The effects of different types of substrates, deposition temperatures and angles of vapour incidence on the microstructures and preferential orientation of the films were considered. The detailed studies reveal an appreciable domain or crystallite size effect, microstrains and nearly total absence of stacking faults. A decrease in the values of D_{av} (the average crystallite sizes) with an increase in the angle of vapour incidence from 26.2° to 44.2° was observed in general. The D_{av} values of films on mica (at room temperature) were less than those on glass (under identical conditions). The dislocation density was found to be $\sim 10^{11}$ cm^{-2}, and the results of line shift analysis indicated small values of σ (average residual internal stress of compressive nature) and $\Delta a, \Delta c$ (lattice parameter changes). A tendency to develop an oriented growth on single crystal substrate KBr at 423K in the thickness range 60-230 nm has been observed both by X-ray and TEM studies.