11.3-1 INCLUSION-LIKE DEFECTS IN InP SUBSTRATES AND RELATED DEFECTS IN HETEROEPITAXIAL AND Zn-DIFFUSED LAYERS
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InP substrates grown by the liquid encapsulated Czochralski technique often contain typical inclusion-like defects (ILDs), which consist of a central core from which dislocation loops are punched out in the <110> directions. It was previously reported that ILDs affect adversely the epilayer morphology.
In the present work the correlation between ILDs in InP substrates and crystal defects in InGaAs and InGaAsP epilayers and in Zn-diffused InP layers has been studied by X-ray topography and scanning electron microscopy.
Evidence for the propagation of dislocation loops from the substrate into the epilayers has been obtained. More in detail, the dislocation loops lined up along the <110> directions inclined by 45° with respect to the interface have been seen to continue in the epilayers.
In addition to this, ILDs behave as starting points for the emission of misfit dislocations. The origin of these dislocations is of course the misfit strain, which depends on the lattice mismatch and the layer thickness. However, the strong anisotropic stress connected to the ILDs provides a suitable nucleation source for misfit dislocations.
An analogous observation has been made in the case of cracks caused by a heavy Zn diffusion in InP crystals. Once again, the present study has shown that ILDs tend to act as sources of cracks.

11.3-2 CRACKS IN InP-BASED HETEROSTRUCTURES.
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InGaAs/InP and InAlAs/InP single heterostructures grown by molecular beam epitaxy and InGaAsP/InP single heterostructures grown by liquid phase epitaxy under large negative lattice mismatch conditions have been investigated in order to clarify the physical mechanisms of crack formation and propagation. X-ray topography and scanning electron microscopy in the integral cathodoluminescence mode have been mainly employed.
In all cases cracks, generated at the epilayer-substrate interface, propagate into both the epilayer and the substrate. Cracks parallel to the $[1\bar{1}0]$ direction originate at a misfit stress level lower than those parallel to the $[110]$ direction, as demonstrated by the unidirectional crack arrangement along the $[1\bar{1}0]$ direction often observed. Moreover, the cracks parallel to the $[1\bar{1}0]$ direction propagate for larger depths into the substrate than those parallel to the $[110]$ direction.
This asymmetric character of the cracks supports the model for their formation already reported (G.H. Olsen et al., J. Electrochem. Soc. 121, 1651 (1974)). This model assumes that cracks are originated by glide and combination of misfit dislocations. On the other hand, it is well known that α-type dislocations, parallel to the $[1\bar{1}0]$ direction, have a higher mobility than β-type dislocations, parallel to the $[110]$ direction. An analogous behaviour is expected to be exhibited by the cracks, as it has been in fact observed in the present work.

11.4-1 PHASON DISPERSION CURVES IN TANTALUM DISULPHIDE BY X-RAY SCATTERING. By W. Minor, L.D. Chapman, S.N. Ehrlich and R. Colella , Physics Dept., Purdue University, W. Lafayette, Indiana, 47907, U.S.A.

The thermal diffuse x-ray scattering in the neighborhood of first order satellites has been measured with high resolution in $1T_1-TaS_2$ (incommensurate phase), using synchrotron x-rays at NSLS (λ=0.711 Å). A total of about 2400 points in q-space have been measured at 363 and 423 K in small "boxes" surrounding two first order satellites, one close to (010) and the other one close to (030). A preliminary analysis shows that Phason Diffuse Scattering (PDS) falls off like q^{-2}, and that the isodiffusion surfaces surrounding a satellite reflection are ellipsoids, reflecting the anisotropy of PDS as predicted by theory[1]. For a satellite whose projection on the hk0 plane is located along the $\vec{b}^*$ axis, the largest ellipsoidal axis is parallel to $\vec{c}^*$, and the shortest one is parallel to $\vec{b}^*$. The ratios of the three axes are 2.5, 1.8, 1. Absolute measurements of the scattered intensity have led to a quantitative determination of the phason velocities (v_ϕ's) in various directions. The value of v_ϕ along $\vec{b}^*$ is about 1.3×10^5 cm/sec, while along $\vec{c}^*$ the velocity v_ϕ is about 1/3 smaller (4.4×10^4 cm/sec). As the temperature is increased from 363 to 423 K, the velocity along $\vec{b}^*$ is essentially unchanged, but along $\vec{c}^*$ the value of v_ϕ is decreased by 13 % approximately. This work will be the first example of a fully determined phason spectrum.

1) A.W. Overhauser. Phys. Rev. **B 3** , 3173 (1971).

11.4-2 COMPILATION OF TEMPERATURE FACTORS OF CUBIC MATERIALS*. By N.M. Butt, B.T.M. Willis+, G. Heger++ and J. Bashir, Pakistan Institute of Nuclear Science and Technology, Islamabad, Pakistan.

The Temperature Factor is an important parameter in crystal vibration studies. It is related to the magnitude of the amplitude of atomic vibration in a crystal. It is therefore an important parameter of interest in reactor technology and crystal physics.

Several experimental techniques are available for the measurement of this parameter. These are diffraction techniques (x-ray, Mossbauer γ-ray, neutron and electron) neutron scattering techniques, elastic constants, specific heat etc. There is a vast amount of literature which gives values of this parameter determined by various methods. However, in several cubic materials these determinations do not agree with one another. An extensive effort has been made to compile the Temperature Factors of Cubic Materials by various methods, particularly the diffraction methods. An attempt has been made to list the most reliable values available on this parameter for various materials. This paper represents the compilation of temperature factors B and the corresponding mean square atomic amplitudes $\langle U^2 \rangle$ and the Debye temperature H of 22 cubic elements namely, Al, Cr, Cu, Ge, Au, Ir, Fe, Pb, Li, Mo, Ni, Nb, Pd, Pt, K, Rh, Si, Ag, Na, Ta, W and V. Similar data on 70 cubic materials namely, AgBr, AgCl, AgF, AlSb, $AuGa_2$, BaO, $Ba(NO_3)_2$, CaO, CaF_2, CdTe, CeO_2, CsBr, CsCl, CsF, CsI, Cr_3Pt, Cr_3Rh, CuBr, CuCl, EuSe, FeS_2, GaAs, GaP, GaS, GaSb, HfC, HgSe, HgTe, InAs, InP, InSb, KBr, KCl, KF, KI, LiBr, LiCl, LiF, LiI, MgO, Mg_2Si, Mg_2Sn, NaCl, NaBr, NaF, NaI, Nb_3Au, Nb_3P, NH_4Cl, NH_4Br, NiO, $Pb(NO_3)_2$, PbS, PbTe, RbBr, RbCl, RbF, RbI, ReO_3, SiC, SnTi, SrF_2, SrO, $Sr(NO_3)_2$, TiC, TiN, TlBr, TlCl, VO_2, W_2C, ZnS, ZnSe, ZnTe, has been compiled. Recommended values of the Temperature Factors have then been given for the cubic