pattern taken with the electron incidence parallel to the fivefold axis, as in the case of Al_6Mn. This deviation was interpreted in terms of inhomogeneously quenched phason strains (T.C. Lubensky et al., Phil. Rev. Letters, 1986, 57, 1440-1442). The detailed inspection revealed that two basic axes which make an angle of 36° or 324° exist in the patterns with a fivefold rotation symmetry. In one axis, the quasi period with $\tau = 1/2(1+\sqrt{5})$ is realized but in the other axis, a different period is formed. It was found that the deviated positions of all the reflections are generated by the addition of the vectors with quasi periods in the two directions. Convergent-beam electron diffraction patterns revealed the point group of the quasicrystal to be $m\bar{3}\bar{5}$, even though a slight break down was observed in mirror symmetry, presumably due to an insufficient quality of the alloy. The weak reflections showing a fivefold symmetry, which we had observed and considered as an evidence of noncentrosymmetric nature (M. Tanaka et al., Proc. XIth Int. Cong. on Electron Microscopy, Kyoto, 1986, p.171-172), were identified as the tails of the first Laue-zone reflections 322101 and 333101 after Elser's indexing (V. Elser, Phys. Rev., 1985, B32, 4892-4898), these being expected from the centrosymmetric point group.

20.4-10 DEFECTS IN Al-Mn-Si ICOSAHEDRAL QUASICRYSTALS STUDIED BY HIGH-RESOLUTION ELECTRON MICROSCOPY. BY K. Hiraga and M. Hirabayashi, The Research Institute for Iron, Steel and Other Metals, Tohoku University, Sendai 980, Japan.

The new phase with the icosahedral symmetry, which has been discovered by Shechtman et al. (Phys. Rev. Lett., 1984, 53, 1951) in rapidly solidified Al-Mn alloys, is considered to be a "quasicrystal" with long-range quasiperiodic translational order and long-range orientational order. Appearance of defects such as phonon, phason and dislocation in the icosahedral quasicrystals have been theoretically discussed with mass-density description utilized for interpreting the icosahedral symmetry (Socolar J. E. S., Lubensky T. C. and Steinhardt P. J., Phys. Rev., 1986, 34, 334).

In this paper, we aim to examine directly structural properties of the defects in quasicrystals with high-resolution electron microscopy. The icosahedral quasicrystal examined was an $Al_{74}Mn_{20}Si_6$ alloy prepared by a melt-quenched method, which is known to form a high-quality quasicrystal. We found that linear phason strains tend to appear perpendicularly to the growth direction of the quasicrystal and to relax in the vicinity of a grown quasicrystal. Dislocations lying nearly perpendicularly to a specimen were observed in high-resolution micrographs taken with the incidence parallel to the five-fold symmetry axis. The Burgers vectors of the dislocations were determined by counting lattice fringes around the dislocation cores. The observed result of dislocations was consistent with a theoretical prediction by Levine et al. (Phys. Rev. Lett., 1985, 54, 1520).

20.4-11 ICOSAHEDRAL SYMMETRY AND DIFFRACTION EXPERIMENT. By V.S. Shekhtman and E.V. Shulakov, Institute of Solid State, Academy of Sciences of USSR, Chernogolovka, USSR.

The observation of new principles of atomic packing in solids requires a more detailed consideration of the group theoretical relationship between the quasi-crystal model and crystal lattices. Only two syngonies, the cubic (23, $m\bar{3}$, 432, $\bar{4}3m$, m3m) and the icosahedral (532, $m\bar{5}m$) appear as maximal finite subgroups of O(3). Two important subgroup chains are 23 532 $m\bar{5}m$ and 23 $m\bar{3}m$. The pentagonal dodecahedron is a simple form for the group m3, if the (10ψ) plane is taken as a starting face ($\psi=(1\pm\sqrt{5})/2$). Note, that in this procedure the application of the cube symmetry operations to the plane in the unique orientation leads to the figure, which is a simple form of the $m\bar{5}m$ supergroup. In view of this the aluminium-manganese, in which the effects of the "icosahedral catastrophy" were first observed should not have been a surprise. Actually, the alloys of aluminium with manganese, iron, silicon involve intermetallic compounds whose structures belong to the space groups Im3, Pm3. So, the possibility of a second order phase transition from the icosahedral group to its cubic subgroup should be taken into account. As far as the diffraction problems are concerned, we shall note that, though the publications in this field are numerous, all the experimental works employ only old methods of structural analysis, by "trial-and-error" methods. It is necessary to find a way to apply the structure factor and interference function in order to use the full set of diffraction maxima intensities in structure recovery. Preliminary experiments showed that the diffraction pattern depends on the icosahedral diffraction mask. We made transparencies, representing two algorithms for "strong" and "weak" Penrose tilings (Fig. 1a,b). The Fourier transforms, realized in an optical diffractometer, yielded different diffraction patterns (Fig. 2a,b).

These demonstrate not only the diffraction maxima, obtained from non-trivial patterns but, also, indicate the alteration of the diffraction pattern, depending on the tiling restructuring.