12-Amorphous, Imperfectly Ordered and Quasi-periodic Materials

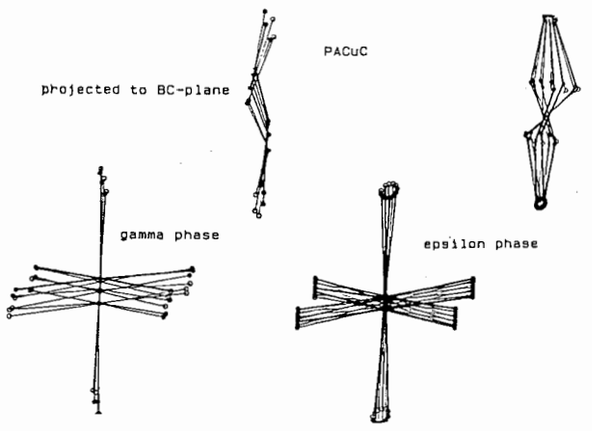

Figure 1 Figure 2
Loci of modulated atoms which are pulled back to the original unit cell of $(C_3H_7NH_3)_2CuCl_4$ in the γ(Fig.1) and ϵ(Fig.2) phases, looking from the a-axis.

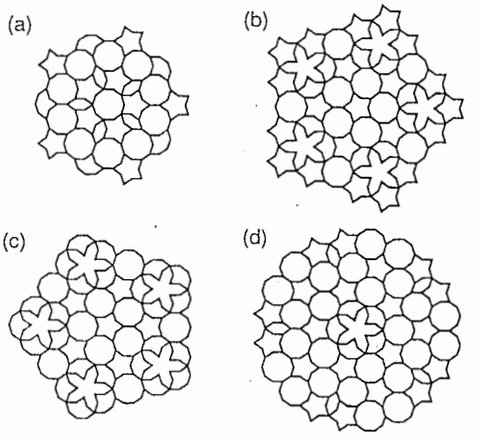

Fig. 1. The occupation domains of d-Al-Pd-Mn. (a) E at z=0.25, (b) D at z=0.25, (c) A at z=0.38 and (d) B at z=0.44.

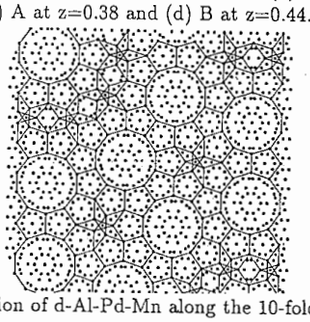

Fig. 2. The projection of d-Al-Pd-Mn along the 10-fold axis.

PS-12.01.12 A FIVE DIMENSIONAL MODEL OF DECAGONAL Al-Pd-Mn QUASICRYSTALS. By Akiji Yamamoto, Nat. Inst. Res. Inorg. Mat. Namiki 1, Tsukuba, 305, Japan

A structure model for decagonal Al-Pd-Mn quasicrystals (d-Al-Pd-Mn) is derived on the basis of theoretical considerations in 5-dimensional space. This can be considered to have a structure similar to d-Al-Mn. Both structures have a period of about 12 Åalong the 10-fold axis. When the structure is described as a three-dimensional section of a five-dimensional decagonal crystal, the location of occupation domains is found from the Patterson map (Steurer, W., J. Phys. Condens. Matter, 1991, 3, 3397-3410). The occupation domains are derived based on the structure of Al_3Mn (Li, X. Z. et al, Phil. Mag. 1992, B 66, 331-340 and Hiraga, K. et al, Phil. Mag. 1993, to appear) and HREM images (Hiraga, K., Proc. Int'l. Conf. on Quasicrystals, St. Luis, 1992). The HREM images clarified that the arrangement of atom clusters is similar to that of pentagonal Penrose patterns with edge length of about 20 Å, while the crystal approximant Al_3Mn suggests the structure of the clusters and their linkage. The d-Al-Pd-Mn quasicrystal (a=2.84, c=12.06 Å, $P10_5/mmc$) consists of 10 flat (8 puckered) layers (Yamamoto et al. Acta Cryst, 1988, A44, 707-714), of which three layers at z=0.25, 0.38 and 0.44 are independent. The layers are composed of large occupation domains shown in Fig. 1 and additional small ones. If the layers composed of atoms derived from the domains E, A etc. in Fig. 1 are described as E, A etc., the layer stacking can be written as BA(E+D)ABCD'(E'+A')D'C, where C, D', E' and A' are layers coming from the occupation domains obtained from B, A, E and D by the screw axis 10_5. The structure projected along the 10-fold axis is given in Fig. 2. The model has atom clusters proposed by Hiraga et al. (1993) and their arrangement seen in the HREM image (Hiraga, 1992).

PS-12.01.13 BURGERS VECTOR OF DISLOCATIONS IN $AL_{62}CU_{25.5}FE_{12.5}$ QUASICRYSTAL DETERMINED BY MEANS OF CONVERGENT-BEAM ELECTRON DIFFRACTION. By Renhui Wang*, Mingxing Dai, Department of Physics, Wuhan University, 430072 Wuhan, China and Beijing Laboratory of Electron Microscopy, Chinese Academy of Sciences, P.O.Box 2724, 100080 Beijing, China

Since the discovery of quasicrystals(QCs) many authors studied defects, especially dislocations in QCs. However, there has been until now no work determining the indices of a six-dimensional Burgers vector **b** of dislocations in icosahedral QCs without any presuppositions. Dislocations in $Al_{62}Cu_{25.5}Fe_{12.5}$ face-centered icosahedral QC were studied by means of the contrast experiment and defocus convergent-beam electron diffraction technique. The indices of the six-dimensional Burgers vector of the dislocations were determined at the first time to be 1/2 [1 -1 1 -1 0 0]. The projection $\mathbf{b}_{//}$of this six-dimensional Burgers vector in the three-dimensional physical space is exactly parallel to a twofold axis of the icosahedron. The magnitude $|\mathbf{b}_{//}| = 0.291$ nm was calculated when a=0.896 nm is taken for the lattice constant of the face-centered icosahedral QC. This is a complete experimental method which can be applied to any type of dislocations in QCs without any presupposition about the Burgers vector. This method may become a standard technique to determine Burgers vectors in QCs.

