tors and the difference Fourier analysis show that the superstructure is disordered and that shifts of the anion clusters can occur along the 02 fergusonite direction.

Incommensurate phase CeNbO$_4$$_{.07}$

The modulation vectors occur in the (010) plane of the fergusonite lattice. The modulation can be reduced to only one incommensurate component which is along the c axis. Its periodicity is the same for different preparations of this phase. Studies of the relationship between an approximate supercell (2 times the fergusonite cell) and that of the fergusonite structure show that the modulation seems to correspond to an irregular distribution of the cation distorted zones. These zones are where the anion insertion occurs. From the comparison of the X-ray intensity distribution in reciprocal space and the fact that the two phases CeNbO$_4$$_{.07}$ and CeNbO$_4$$_{.25}$ could coexist in the same crystal, it can be deduced that the same anion insertion mechanism is valid for both phases. The cation distortion is closely related to the tetragonal twin formation and the distortion distribution in the crystal is parallel to the twin walls (this does not hold when Ce is substituted by (La, Th)).

The investigation of hydrogen interstitial solid solutions in Pd-Cu alloys has culminated in the discovery of an unusual phenomenon: hydrogen stimulates the ordering of the alloy lattice. Under usual conditions the ordering in Pd-Cu alloys occurs near compositions Pd$_{40}$Cu$_{60}$ and Pd$_{40}$Cu$_{50}$ in alloys with a higher palladium content (> 50 at%) the ordering is not realized. Early experiments on polycrystalline samples had shown that in the alloy Pd$_{40}$Cu$_{60}$ the hydrogenation causes a tetragonal lattice distortion which is indicative of the ordering (Detyarveva et al., Phys.Stat.Sol.(a), 77, 1981). This structure transformation has been studied in detail on a monocristalline alloy Pd$_{40}$Cu$_{60}$ held in an atmosphere of hydrogen at P$_H2$=11 kbar and T=300°C for 12 hours (the hydrogenation to the composition O5).

The study has been carried out by oscillating Pd$_{40}$Cu$_{60}$H single crystals about the directions that correspond to [100], [001] and [110] of the initial cubic crystal. The oscillating-crystal X-ray photographs show the splitting of reflections which corresponds to the tetragonal lattice distortion. The appearance of superstructural reflections have also been observed. By oscillating about [110] they formed new layer lines with the identity period $\parallel a$=$a_{0}$.$\sqrt{2}$.

The analysis and indexing of X-ray photographs for hydrogenated Pd$_{60}$Cu$_{40}$ single crystal made it possible to present the crystal reciprocal lattice as a superposition of two tetragonal lattices which have a coincident axial vector E and are mirror symmetrical to each other (see the figure). The transformation from the cubic structure to the tetragonal one is accompanied by twinning with invariant plane (011). The ordered tetragonal structure has the type CuAuI(4f) the space group is P4/mmm. This type of ordered structure corresponds to the equatomic relation of the alloy components. Consequently, the ordering in PdCu alloy during hydrogenation is realized by CuAuI-type and not by the PdCo(32) one. Probably, this is connected with the change in the electron concentration of alloys due to hydrogenation.