X-ray analysis was carried out under normal conditions. Academy of Metal hydrogenation is known to cause a change in the alloy trans-armed to a h.c.p. structure by f.c.c. interaction by changing essential factors such as:

- Conditions after removing hydrogen. These investigations showed that interstitial hydrogen affects the interatomic disarrangement of orientation of the alloys (after partial hydrogen removing).
- Pd-Cu. Initial f.c.c. Pd₈Cu₄₀ alloy was found to be ordered after hydrogenation with respect to the metal sublattice. The 111-CuAu₂ type of the ordered structure was formed by twinning. Pd-Ni. A single crystal equi-atomic (initial and hydrogenated) alloy was used to study decomposition of f.c.c. solid solution into two f.c.c. phases, enriched with Pd and Ni. The main crystallographic directions of crystals after decomposition were shown to retain the disarrangement of orientation of the two new f.c.c. sublattices which is about 6° off the [110] direction. Fe-Co. It was found that the b.c.c. equi-atomic Fe-Co alloy transformed to a h.c.c. structure by interstitial hydrogen. The latter structure was retained under normal conditions after removing hydrogen. These investigations show that interstitial hydrogen affects the interatomic interaction by changing essential factors such as:

1. Diffusion of metal atoms
2. Interatomic distances
3. Electron concentration

As a function of self-irradiation the expansion of the lattice constant of ²³⁹Pu₁₂₅ has been followed for approximately five years. Expansion is caused primarily by the retention of He bubbles in the lattice. The X-ray diffraction line width remains quite narrow for rather extended periods of time indicating that the "crystal cage" is relatively insensitive to damage from the radioactive atom contained within the lattice.

After reaching a maximum value the lattice constant decreases as the accumulated He bubbles diffuse out of the lattice. The time required to reach a maximum is dependent on the size of the radioactive atom. Comparison with data from ²³⁸Pu(²³⁸Pu, Advances in X-ray Analysis, 1974, 17, 340-353) and ²³⁹Pu(²³⁹Pu, currently under investigation) indicates that the more intense the radiation the sooner the maximum value of the lattice constant is obtained.

Metal hydrogenation is known to cause a change in the properties and crystal structure of metals. Structural transformations of the binary solid solutions by interstitial hydrogen have been studied in some transition metal alloys. The alloys were saturated by hydrogen at high pressure (10-30 kbar) and ambient temperature (200-300°C) to the ratio H/Me=0.5-1.0. The X-ray analysis was carried out under normal conditions (after partial hydrogen removing). Pd-Cu. Initial f.c.c. Pd₈Cu₄₀ alloy was found to be ordered after hydrogenation with respect to the metal sublattice. The 111-CuAu₂ type of the ordered structure was formed by twinning. Pd-Ni. A single crystal equi-atomic (initial and hydrogenated) alloy was used to study decomposition of f.c.c. solid solution into two f.c.c. phases, enriched with Pd and Ni. The main crystallographic directions of crystals after decomposition were shown to retain the disarrangement of orientation of the two new f.c.c. sublattices which is about 6° off the [110] direction. Fe-Co. It was found that the b.c.c. equi-atomic Fe-Co alloy transformed to a h.c.c. structure by interstitial hydrogen. The latter structure was retained under normal conditions after removing hydrogen. These investigations show that interstitial hydrogen affects the interatomic interaction by changing essential factors such as:

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