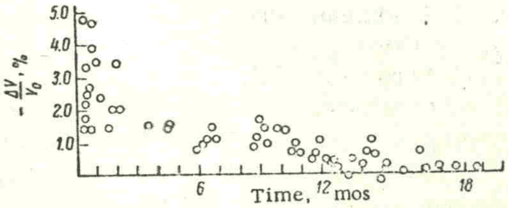

Fig. 3. Variation of the volume decrement of γ-Ce under a slow and gradual reduction of pressure down to atmospheric.

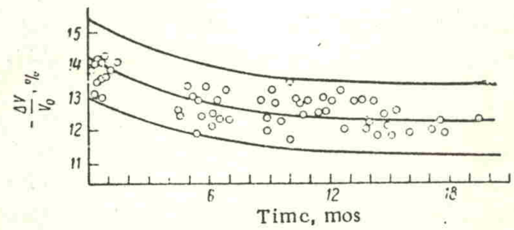

Fig. 4. Variation of the volume decrement of α-Ce under a slow and gradual reduction of pressure down to atmospheric. V_0 is the unit cell volume of α-Ce at 1 atm; $\Delta V = V_0 - (V_P)_\alpha$, where $(V_P)_\alpha$ is the unit cell volume of α-Ce at the pressure P.

2 shows the pressure dependence of the bulk compression modulus $k = -\frac{V}{\left(\frac{\partial P}{\partial V}\right)_T}$. The values of k were calculated from the formula $k = \frac{V_1 + V_2}{2} \cdot \frac{P_2 - P_1}{V_1 - V_2}$; it is apparent that for the gamma phase of Ce the modulus k exhibits anomalous behavior as the pressure varies, while for all the other metals the bulk compression modulus increases. The x-ray data unfortunately do not permit any definite conclusions relative to the nature of the dependence $(\Delta V/V_0) = f(P)$.

One x-ray analysis showed that the initial phase of cerium tends to persist to pressure considerably in excess of the transition pressure 7000 kg/cm²; the presence of weak lines typical of this phase could be detected even at a pressure of 14,000 kg/cm². A similar lag in complete transformation was observed by Itskevich [10] at pressures of 10,000 kg/cm² and at room temperatures. It is necessary to point out that the high-pressure phase often persists down to very low pressures; when the pressure was lifted very gradually we found that the compact cubic phase remained in existence down to atmospheric pressure.

One case worthy of mention arose when the compact phase was created at atmospheric pressure. This happened as the result of lifting the pressure at an extremely slow rate (over a two-year period). In this experiment the beryllium pressure receptacle was forced tightly into the steel bomb and the cylindrical opening was filled with the sample. The quasi-hydrostatic pressure on the sample differed from the pressure in the bomb and was evaluated from the shift of the γ-phase lines relative to their positions at atmospheric pressure. After the piston was freed the pressure in the chamber was reduced to zero, while the pressure on the sample remained equal to 6000 mg/cm². The two-year observation of this sample showed that the pressure gradually dropped to zero, as is apparent from examination of Fig. 3. The graphical time dependence of the relative change in volume for the compact cubic α-phase was constructed from the x-ray photographs of this experiment. It is apparent from Fig. 4 that the curve approaches a value of 12.4%. Hence it is possible to produce the lattice constant of the collapsed fcc form of cerium at atmospheric pressure. This constant turns out to be equal to 4.94 A.

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