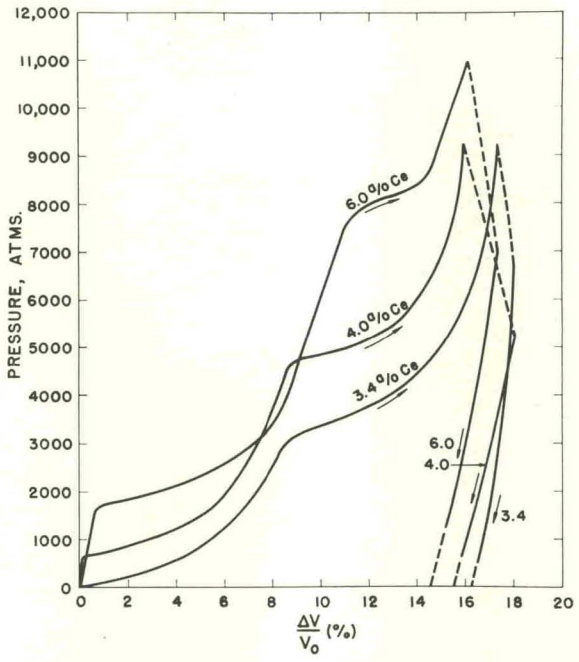

Fig. 7. Curves showing the effect of a cycle of compression and decompression on the per cent change in volume of delta-plutonium alloys containing cerium in the concentrations of 3.4–6.0 a/o.

plutonium alloy containing between 1.9 and 3.4 a/o Ce is heat-treated at 450°C and air-quenched, it should consist mostly of beta phase. The minimum amount of cerium required to retain delta phase at room temperature with the heat treatment being used is 3.4 a/o Ce.

Compression curves of delta-stabilized alloys containing 4.0, 6.0, and 10.0 a/o Ce are shown in Figure 10. These alloys were compressed through the lower pressure transformation only to maximum pressures of either 10,000 or 1000 atm less than that required to attain the higher pressure transformation, whichever was lower. This figure shows that the transformations are irreversible in the 4.0 a/o Ce alloy, partly reversible in the 6.0 a/o Ce alloy, and completely reversible in the 10.0 a/o Ce alloy. Note that the extent of reversibility increases with increasing cerium content in these alloys. The trans-

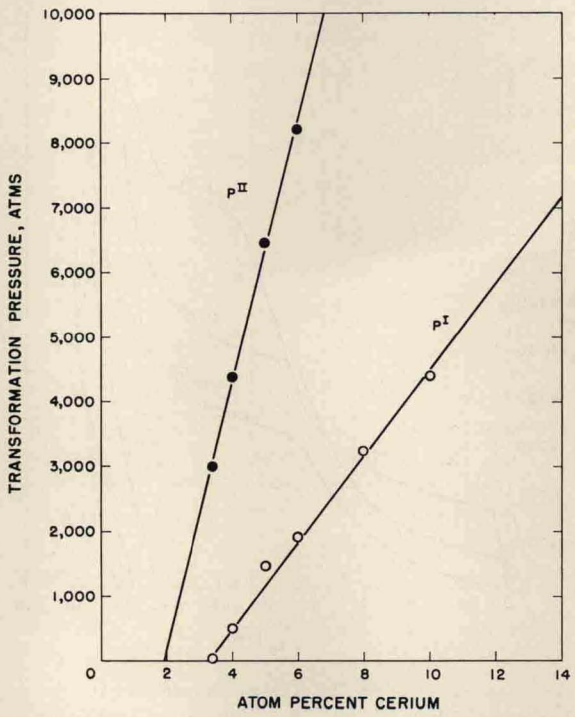

Fig. 8. Curves showing the effect of cerium content on the pressure, P^{I}, necessary to cause plutonium-cerium alloys to transform almost completely from delta to beta (plus some gamma) and on the pressure, P^{II}, necessary to cause the alloys to transform from beta (plus some gamma and residual delta) to alpha.

formation becomes completely reversible in the alloys containing more than 7.1 a/o Ce. This irreversible transformation was found to be caused by a change of the metastable delta phase into mostly beta phase plus small amounts of gamma and some untransformed delta, the amount of untransformed delta increasing with increasing cerium content. The transformation occurs rapidly at room temperature and the beta-phase microstructure in the alloy containing 4 a/o Ce resembled that of a diffusionless, martensitic transition. This high-pressure treatment can thus be used to retain beta-phase plutonium that is free of voids and microcracks at room temperature.

The second, higher pressure transformations are irreversible (see Fig. 7) and result from the change from beta to alpha. The alloys,