

Pu-In	3.4 a/o In	9,100	1520	13.1	12.4	2.5	15.56	17.83
Pu-Ce	3.4 a/o Ce	10,600	I. ≤ 60	≥ 8.6	—	—	15.63	—
	3.4 a/o Ce	10,600	II. 3000	9.1	16.3	—	—	18.76
	4.0 a/o Ce	9,880	I. 500	8.4	—	I. 1.9	15.56	—
	4.0 a/o Ce	9,880	II. 4380	8.3	15.5	II. 4.2	—	18.55
	5.0 a/o Ce	9,250	I. 1460	7.9	—	I. 1.9	15.46	—
	5.0 a/o Ce	9,250	II. 6470	7.8	15.8	—	—	18.02
	6.0 a/o Ce	11,000	I. 1920	7.8	—	I. 3.0	15.31	—
	6.0 a/o Ce	11,000	II. 8220	6.2	14.6	II. 6.0	—	17.86
	8.0 a/o Ce	10,000	I. 3230	6.9	—	I. 5.4	15.13	15.16
	8.0 a/o Ce	10,000	II. N.T. ^b	—	—	II. 6.5	—	—
	10.0 a/o Ce	10,000	I. 4400	5.7	—	I. 8.4	14.96	14.93
	10.0 a/o Ce	10,000	II. N.T. ^b	—	—	II. 6.8	—	—

^a Values obtained by extrapolation of pressure-volume curves.

^b N.T. means no transformation.

glycerine, and movable piston are inserted at the opposite end. This assembly is then fitted into the guide and protecting cylinder. Dial indicators, which measure linear displacement of the movable piston, are attached to the piston holder and guide.

The apparatus* is shown assembled in Figure 2. Force is applied to the movable piston by means of a 50-ton press, and the resulting pressure within the high-pressure cylinder is transmitted hydraulically to the specimen by the glycerine. This liquid was used because it does not react with plutonium and because it is relatively incompressible. A Baldwin SR-4 load cell, calibrated for pressure measurement at the solidification point of mercury, 8850 atm and 7.5°C, was used to measure the pressures.† Dial indicators located on opposite sides of the cylinder measure linear displacement of the movable piston. Volume changes in the specimen, however, cannot be calculated directly from the dial indicator readings because the glycerine compresses, the cylinder expands, and the pistons shorten as the pressure increases. Corrections for the compression of the glycerine were made from values published by Bridgman,⁴ and for the dimensional changes of the cylinder and pistons from calculations based on elastic theory. The volume measurements were checked with an aluminum standard.‡ All measurements were taken at $24 \pm 1^\circ\text{C}$ unless otherwise noted.

Results and Discussion

The results obtained with delta-stabilized Pu-rich binary alloys containing Al, Zn, In, and Ce are summarized in Table I. Transformation pressures listed in this table were obtained by extrapolating the pressure-volume curves at the transformation breaks; volumes of transformation are the percentage volume changes at the pressures of transformation; and permanent volume changes are the percentage volume changes of the alloy after compression and return to ambient pressure. Most of the values given in Table I are mean values.

* The maximum pressure to which the apparatus can be repeatedly subjected is about 10,000 atm; slightly higher pressures can be attained but only at the expense of great reduction in the life of the high-pressure cylinder and pistons.

† Accuracy of pressure measurements is estimated to be ± 200 atm.

‡ Accuracy in determining volume changes is estimated to be $\pm 10\%$ of the value reported.