

Delta-phase plutonium can easily be retained at room temperature by the proper combination of alloying and heat treating. Alloys of this type are frequently referred to as delta-stabilized alloys. Actually, the delta phase in many such alloys is metastable and it will transform to a more stable state when heated or compressed. We have prepared a number of delta-stabilized plutonium alloys containing Al, Zn, and Ce, and have observed their behaviors at pressures up to 11,000 atmospheres. Many of these alloys transformed under compression, and their transformation pressures, transformation volume changes, and compressibilities were determined as a function of composition.

We made our alloys by melting in an induction furnace under vacua and casting into ingots about 1/2" O.D. x 1-3/4" long. These ingots were homogenized in the delta region at 450°C for at least 200 hours, air-quenched to room temperature, and, finally, machined to right cylinders 0.434" O.D. x 1.5" to 1.7" long.

The compression measurements were made in the simple piston and cylinder device shown in Slide 1. The stationary piston is placed in one end of the high-pressure cylinder, the specimen and glycerine are then inserted at the opposite end, followed by the insertion of the movable piston. Dial indicators are attached to the movable piston holder and guide and these indicators measure the linear displacement of the movable piston.

The apparatus is shown assembled in Slide 2. The force is applied to the movable piston with a 50 ton Lombard press. A Baldwin SR-4 load cell is used to measure the pressure, which is transmitted hydraulically to the specimen with the glycerine. Volume changes are not obtained directly from