

Plutonium Casting and Forming continued)

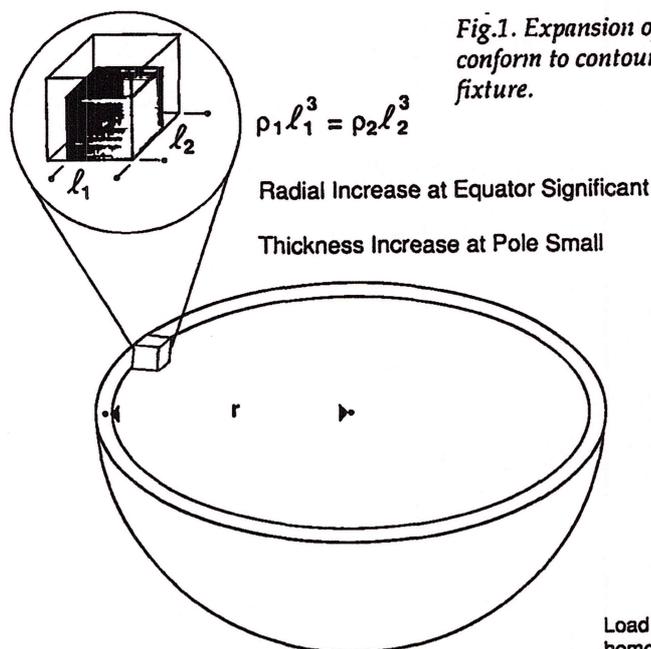
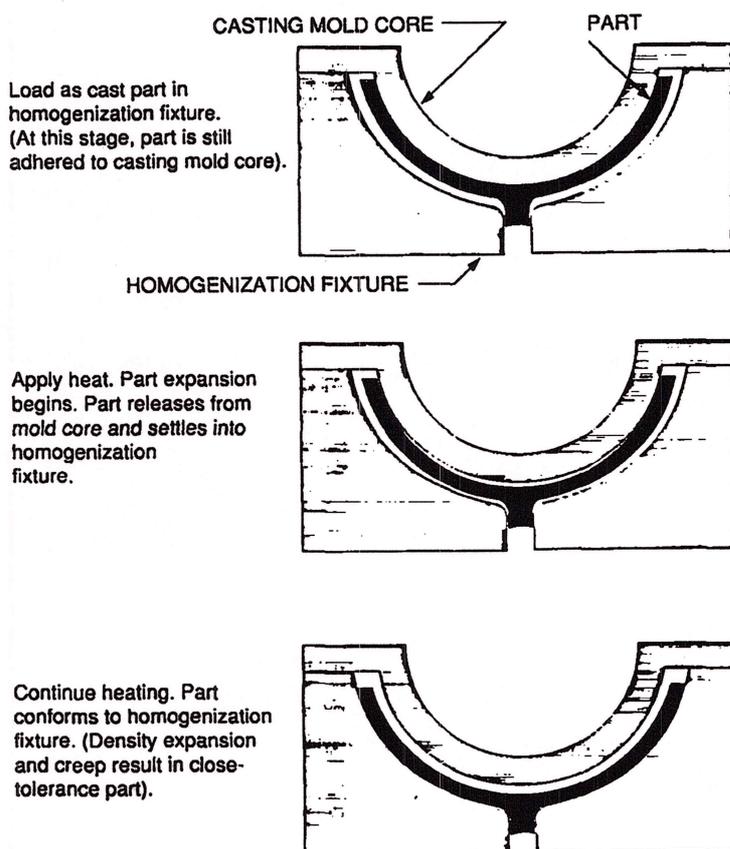


Fig.1. Expansion of plutonium to conform to contour of heat-treatment fixture.

The split-mold design allows easy release of the plutonium cast part from the outer case. Figure 1 shows how expansion during the phase change resulting from heat treatment causes the part to move out radially and closely conform to the contour of the heat-treatment fixture. Figure 2 shows how the core of the plutonium casting mold is positioned in the heat-treatment fixture and how the plutonium casting releases from the mold core during heat treatment and settles into the heat-treatment fixture.

Fig. 2. Simplified depiction of density expansion and creep forming during heat treatment.



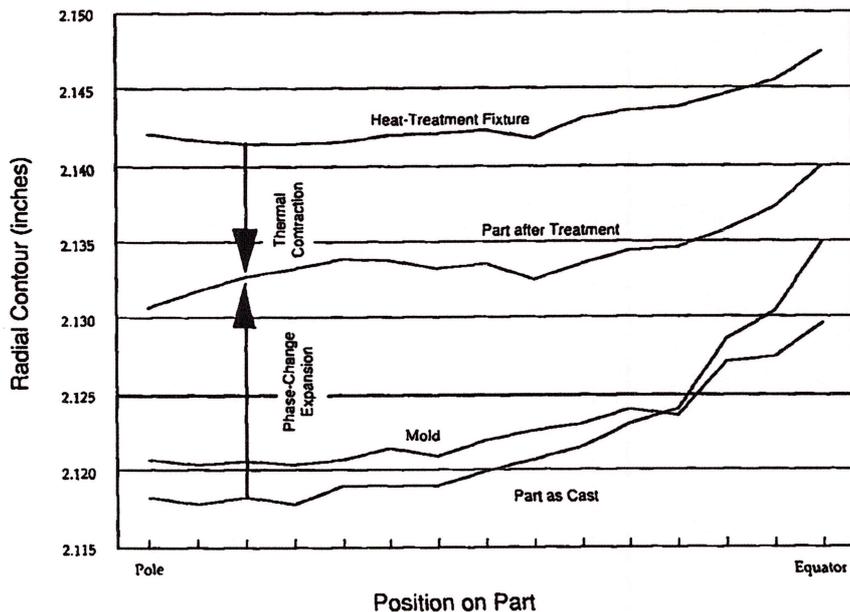


Fig. 3. Inspection data at various stages of the subscale casting process.

The creep of the plutonium part caused by gravitational force contributes to this hot forming process. In the future we will be testing a low-thermal-expansion metal fixture.

Figure 3 summarizes the inspection data recorded at various stages of the subscale process. The contour of the plutonium part after heat treatment closely follows the contour of the heat-treatment fixture.

Summary

Los Alamos scientists are developing a production process for near-net-shape gravity casting, heat treatment, and forming of plutonium parts. Key elements in the process are gravity casting to shape, split-mold design for easy part release, and use of phase change and creep during heat treatment (homogenization) to expand the plutonium part into a close-tolerance heat-treatment fixture.

By using bottom-pour and tilt-pour plutonium casting furnaces, the process applies existing technology rather than developing major new equipment, as would be required in a die-casting process. ♦

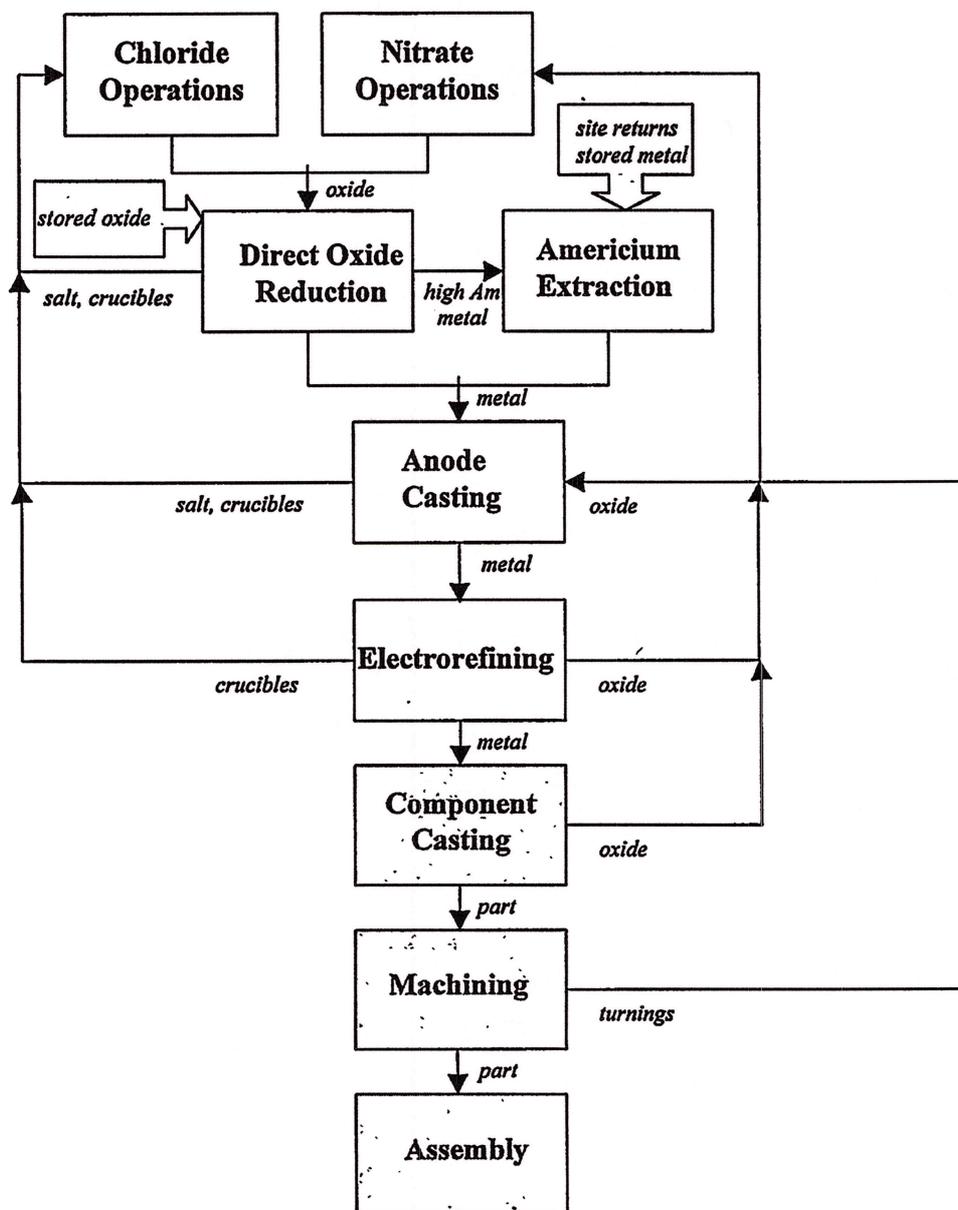


Figure 2. Simplified Flowchart for Pit Production

Electrorefining

This is the pyrochemical process for producing high-purity plutonium. The product metal is used as feed for the component casting process. Residues are produced for recovery by aqueous processing or discard by waste management.