

RECOMMENDED HANDLING PROCEDURES FOR:
La, Ce, Pr and Nd

I. Storage

These metals will oxidize slowly at room temperature in air. They should be stored under 10^{-3} torr or better vacuum or in sealed jars under an inert gas. For long term storage the best method is to seal these metals in evacuated Pyrex tubes with the ends sealed by fusion. Oils should not be used.

II. Cleaning

Even when stored as described above, some surface oxidation will occur. The oxidation should be removed by filing. A wire-brush wheel may also be used, but filing is preferred. If the surface has already turned white, at least one mm of metal should be removed to ensure the removal of intergranular corrosion products which are present near the surface. After filing, the cold worked surface can be removed by electropolishing (see below) which also passivates the surface.

III. Electropolishing

An electrolyte of 1% (or up to 6%) perchloric acid in absolute methanol is stirred and cooled continuously in a dry ice-acetone bath. A platinum cylinder (cup) serves as the cathode. A current density of about 0.5 amps/cm² usually is required. A variable voltage supply should be used and the amperage controlled to give small bubbles at the surface of the sample. The electrolyte should not be allowed to bubble excessively. The sample should be rinsed while cold in the dry-ice acetone bath, then rinsed with copious quantities of methanol. [If pure fcc cerium is required, a room temperature etch should be used since some dhcp cerium will form on cooling to dry-ice temperatures. Roman's solution is recommended: Koch and Picklesimer, Trans. Met. Soc. AIME 239 759 (1967).]

IV. Cutting

A metal saw (hack saw or jeweler's saw), or a low speed diamond saw, or a spark cutter may be used. The metal should be electropolished after cutting since the freshly cut surface is quite reactive. Shearing is not recommended unless the sheared surface is filed off. The low speed diamond saw or the spark cutter are recommended as the best method for obtaining a strain-free surface.

V. Cold Working

These metals can be cold swaged or rolled about 30% reduction in cross section without heat treatment. To prevent contamination, they should be wrapped or (even better) sealed in tantalum.

VI. Handling

Since these metals react primarily with moisture, they should not be touched with bare hands. Plastic gloves are recommended. They can be handled in air, but an oxide layer does form quite quickly. This layer can be removed and the surface passivated by electropolishing (see III above).

VII. Stress Relief

The surface should be freshly cleaned by electropolishing just prior to heat treatment. A vacuum of 10^{-3} torr or better is required to prevent contamination. Minimal contamination will occur at 10^{-3} torr if the samples are wrapped in clean tantalum. The recommended temperature is half of the melting point in K for about 8 hours. (If pure d-hcp La is required, a special procedure must be used - contact K.A. Gschneidner, Jr., see below.)

VIII. Melting

These metals may be arc or electron beam melted. Levitation and induction heating in outgassed tantalum or tungsten crucibles are also suitable. If these metals are heated in tantalum or tungsten to temperatures significantly above their melting points, tantalum and tungsten will dissolve in the molten rare earth [for details see Dennison, Tschetter, Gschneidner, J. Less-Common Metals 11, 423-35 (1966)].

If other questions arise, please contact the Materials Preparation Center at the Ames Laboratory, US DOE, Ames, IA.