

RECOMMENDED HANDLING PROCEDURES FOR:
Sc, Y, Gd, Tb, Dy, Ho, Er, Tm and Lu

I. Storage

These metals do not oxidize at room temperature in air. However, for long term storage, closed containers are recommended. Oil should not be used.

II. Cleaning

If surface oxidation has occurred due to exposure to acid fumes or slightly elevated temperatures, the major portion should be removed by filing and the final polishing done electrolytically (see below).

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.

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 without cleaning the surface before they are heated. Plastic gloves are recommended. They can be handled in air. However, as mentioned above, strained surfaces from cutting or filing should be removed by electropolishing (see III above).

VII. Stress Relief

The surface should be freshly cleaned by electropolishing just prior to heat treatment. A vacuum of 10⁻⁶ torr or better is required to prevent contamination. Minimal contamination will occur at 10⁻⁶ torr if the samples are wrapped in clean tantalum. The recommended temperature is half of the melting point in K for about 8 hours.

VIII. Melting

These metals may be arc or electron beam melted. (Due to its high pressure, Thulium can not be melted and can be arc melted only with great losses of metal). Levitation or induction heating in outgassed tantalum or tungsten crucibles are also suitable. If these metals are heated in tantalum to tungsten or a temperature above their melting points, tantalum and tungsten will dissolve in the molten rare earth [for details see Dennison, Tschetter, Gschneidner, J. Less-Common Metals 10, 108-15 (1966) and 11, 423-35 (1966)].

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