

RECOMMENDED HANDLING PROCEDURES FOR: Sm and Yb

I. Storage

These metals will oxidize very slowly at room temperature in air. They should be stored under 10^{-6} 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. 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

For Sm: 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.

For Yb: A chemical polis of 5-8 ml HNO₃, 58 ml H₃PO₄ and 22 ml of methanol swabbed on for 10 seconds works well. Electropolishing with 10 vol.% HCl in methanol at room temperature also works. See Beaudry and Gschneidner in Handbook on the Physics and Chemistry of Rare Earths, Vol. 1, 209 (1978) North Holland Publishing Co., Amsterdam.

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

Sm can be cold swaged or rolled only about 10% reduction in cross section, while Yb can be cold worked 50% or more without heat treatment. To prevent contamination both 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, especially if they are to be heated. Plastic gloves are recommended. They can be handled in air, but an oxide layer does form slowly. This layer can 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

Sm may be arc melted but not Yb. Induction heating in sealed outgassed tantalum or tungsten crucibles is most suitable. If these metals are heated in tantalum or tungsten to a temperature 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.