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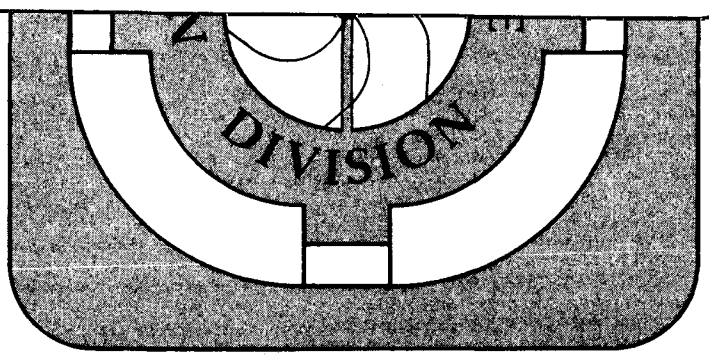

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DISCLAIMER

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THE MANUFACTURE OF THIN SELF-SUPPORTING ^{238}U FOILS*

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Abstract:

A method is described for the manufacture of self-supporting ^{238}U foils of thickness within the range 400 to 1400 $\mu g\ cm^{-2}$.

The study of giant resonances excited by inelastic heavy-ion scattering places stringent conditions on target production. This is because the broad structures seen in the heavy ion inelastic spectrum, resulting from the giant resonances, originate not only from the nuclei of interest but also from nuclei associated with the target backing material and any target contaminates. Furthermore, the recent interest in the decay properties of giant resonances requires the use of thin targets, especially for the actinide nuclei where one of the principle decay channels is fission. Here we report the manufacture of thin self-supporting ^{238}U targets that were developed for these decay study experiments.

The basic principle of manufacture involves electron bombardment within a vacuum chamber of a 300-400 mg. chip of metalic ^{238}U contained in a tungsten crucible. The evaporated Uranium is collected on glass slides in a water cooled holder 4" from the crucible. The Tungsten crucible has a diameter and depth of 1/4", with a hole of 3/16" Dia and 1/8" depth to contain the Uranium. The hole is drilled by an ultrasonic process. The electron source filiment is a loop of wire 1/2" in diameter and 1/4" above the tungsten crucible. The voltage between the source filiment and crucible could be varied up to 17 kilovolts. The only successful way we have found to prepare the glass slides is to polish them with a petroleum solvent based metal polish. For the other methods of preparation we have tried, the deposit adheres too strongly to the glass. The electron bombardment of the Uranium should not

begin until the chamber pressure is better than 4×10^{-7} mm, and during the evaporation the pressure should not exceed about 4×10^{-6} mm. It is important to use as little heating power as possible consistent with an evaporation rate of 1 to 2 $\mu g/cm^2/sec$. A thickness monitor such as a quartz crystal oscillator is of some help here to control the deposition rate. If the power dissipated on the crucible exceeds about one kilowatt and or the chamber pressure increases beyond 4×10^{-6} mm then the chance of producing a useful non-stressed deposit rapidly diminishes.

After the evaporation the chamber is allowed to cool before it is vented with dry ^4He gas. The glass slides are then transferred to a glove box flowing dry argon gas. It is essential to protect the deposits both from atmosphere oxygen and moisture, even moisture from uncovered hands will cause rapid deterioration. The Uranium deposit is then cleaved from the glass slides by means of a sharp single edged razor blade. Once the foils are mounted on frames they should be stored in a vacuum of 10^{-6} mm; at higher pressures the foils will eventually disintegrate.

By the method outlined here foils have been produced which have a diameter of 2 cm and have thicknesses within the range 400-1400 $\mu g/cm^2$. The uniformity of the foils was determined by α particle transmission methods and was found to be generally better than 5% across the diameter of the foils.

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