Preparation of Gd and Cd targets at Texas A&M University


Accelerator-based experiments in the Heavy Elements Group have required the preparation of thin targets of lanthanide elements. Targets of $^{156,157,158,160}\text{Gd}_2\text{O}_3$ and $^{\text{nat}}\text{CdO}$ were prepared in the last year using the Molecular Plating (MP) technique [1,2]. The $\text{Gd}_2\text{O}_3$ samples were prepared by dissolving ~1 mg of $\text{Gd}_2\text{O}_3$ in 2 M $\text{HNO}_3$ and evaporating to dryness under Ar gas. Each sample was then reconstituted with 5-10 $\mu$L of 0.1 M $\text{HNO}_3$ and 10-12 mL of anhydrous isopropanol. The $\text{CdO}$ samples were prepared via the same method except the starting material was $^{\text{nat}}\text{Cd}$ metal instead of the oxide. The body of the electroplating cell is made from PEEK [3]. A Pt disk was used as the anode, and a 2 $\mu$m Ti foil served as the cathode and the backing onto which the material was plated.

The deposition voltage was 600-700 V with a current density of ~2 mA/cm². Deposition times ranged from 30-60 min. After deposition, the targets were baked in air at 200 °C for 30-60 min to convert the material to the oxide. The resulting targets had thicknesses between 225-655 $\mu$g/cm² as determined by weighing. The plating efficiencies were between 50-100%. $\text{Gd}_2\text{O}_3$ targets were characterized using secondary ion mass spectrometry (SIMS) to determine isotopic enrichment. Results are summarized in Table I.

Future beam experiments will use a rotating target wheel to allow for use of higher beam currents [4]. An electrochemical cell based on the designs of Haba et al. [5] has been constructed to make targets for the rotating wheel, and first results are reported here. A schematic of the cell is shown in Fig. 1. One arc-shaped target of $^{\text{nat}}\text{Gd}_2\text{O}_3$ has been fabricated as a proof-of-principle. The $^{\text{nat}}\text{Gd}$ sample was prepared as described above with enough isopropanol added to ensure the plating solution covered the entire arc.
The deposition was done for 60 min at 700 V. The resulting target is shown in Fig. 2. The thickness was 438 μg/cm² and the plating efficiency was 95%.