Fabrication of self supporting enriched ^{160}Gd target

Jasmeet Kaur[1], D. Kabiraj[2], Abhilash S. R.[2], A.K. Bhati[1,*]

[1]*Centre of Advanced Study in Physics, Physics Department, Panjab University, Chandigarh, India*

[3]*Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi ,India*

* email: akbhati@pu.ac.in

Introduction

Target development laboratory of IUAC has successfully fabricated ^{160}Gd targets of ~1mg/cm^2 thickness. Rolling technique was used for the fabrication. Initial thickness of the ^{160}Gd foil was 201mg/cm^2. The foil was supplied by M/s Isoflex, Russia. High oxidation [1-2] tendency of Gd and burning of the Gd foil were the major constraints in this work. Burning of the foil was due to the discharge of electric charge accumulated on the foil surface.

Experimental procedure

The amount of available stock of ^{160}Gd was 60mg only. It was not of adequate quantity for making targets by vacuum evaporation technique. In order to minimize the material consumption, it was decided to opt rolling technique for the target fabrication of ^{160}Gd. The view of rolling is shown in Fig.1. Several attempts were performed with natural Gd sheet prior to isotopic material to ensure maximum success in the rolling of isotopic material. Initially the enriched Gd foil of thickness of ~201mg/cm^2 was placed inside the folder of stainless steel sheet having polished surface. The stainless steel sheet folder was then fed into the rolls of rolling machine. Frequent replacement of steel folder, removal of dust particle deposited on the foil and gradual adjustment of gap between the rolls are essential for the successful fabrication of Gd Target. It consumed several steel folders and several hours to reduce the thickness of the foil up to ~1mg/cm^2.

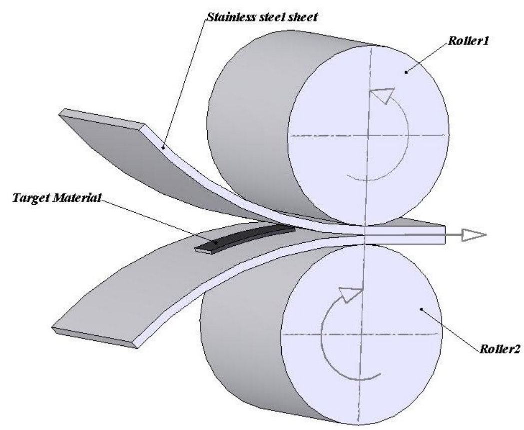

Fig. 1 Schematic of rolling machine.

When the surface area of the Gd foil was significantly increased, oxide layer was formed on the foil surface. An uninterrupted flow of Argon was maintained in between the rolls to create an inert environment. Inert environment having maximum abundance of Argon was for decelerating the oxidation of Gd foil during rolling.

Burning of the foil was another major difficulty faced in the rolling of Gd targets. In the precise observation it was noticed that, the burning of foil was taking place due to the spark in between the tip of forceps and foil while moving the foil. The spark was observed when foil thickness was less than ~10mg/cm^2. Strong tendency of Gd to burn in air, accumulation of electric charge due to friction in rolling were the reasons. Static electricity becomes visible and dynamic during the brief moment it sparks a discharge and for that instant it's no longer at rest. Low humidity in air also can enhance the spark. An antistatic wrist strap with uninterrupted flow of Argon was very effective in protecting the Gd foil from burning. A metallic clip was also attached to the Anti static wrist strap. The Gd foil, forceps, stainless steel folder and rolls were frequently earthed by the metallic clip and the wrist strap of antistatic wrist strap. Fig.2 shows the antisatic wrist starp used to avoid the electric discharge.

Fig. 2 Antistatic Wrist Strap

After reaching the required thickness of 1mg/cm^2, the ^{160}Gd foils were carefully mounted on a target frame. A vacuum desiccator filled with Argon gas was used to store the target for long duration. These precautions were taken throughout, till the mounting of the target to the target holder in the beamline. ^{160}Gd target was successfully used for a nuclear physics experiment at IUAC.

Conclusion

A ^{160}Gd target of 1mg/cm^2 was successfully prepared in Argon gas environment by using mechanical rolling technique with the help of an Anti static wrist strap.

References

[1] R. Pengo *et al*., Nucl.Instr. and Meth. A **303** (1991) 146.
[2] V. Kumar et al., Nucl.Instr. and Meth. A **613**(2010) 401.