Fabrication of ^{130}Te targets with Au backing

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Introduction

Target fabrication plays a very important role in nuclear physics experiments. Thickness of the targets varies from μg/cm^2 to few mg/cm^2 depending upon the requirement of the experiment. ^{130}Te targets of ~1mg/cm^2 thickness with Au backing were required for our proposed experiment. Enriched isotopic targets have been fabricated by means of conventional techniques such as thermal evaporation method using resistive heating. The thermal evaporator uses an electric resistance heater to melt the material and raise its vapor pressure to a useful range. This is done in high vacuum to allow the vapor to reach the substrate without reacting with or scattering with other gas phase atoms in the chamber, and reduce the impurities from the residual gas in the vacuum chamber. These techniques are extensively used for tellurium target preparation up to about 1mg/cm^2 [1-3].

In the present work, isotopically enriched ^{130}Te targets with Au backing were fabricated by resistive heating of graphite crucible in high vacuum evaporation chamber at the target laboratory of Inter University Accelerator Centre (IUAC).

Procedure of fabrication

The evaporation of ^{130}Te on the Au backing was carried out in high vacuum evaporator chamber. Before the evaporation of enriched ^{130}Te, few trials have been taken with natural tellurium to optimize the parameters. For the backing, Au foils of thickness ~ 4mg/cm^2 and 6mg/cm^2 were prepared using the rolling machine. For the evaporation, tellurium was placed in the graphite crucible. Au foil was pasted on the target frame with the help of silver paste. Then the target frame with the gold foil was kept in the center with two glass slides on its both sides on the target holder. The target holder was kept at a distance of 2cm from the graphite crucible. To avoid the heating of target a heat shield was placed at a distance of 1cm from the graphite crucible. Figure 1 shows the setup used for the evaporation of tellurium on the gold foil in the high vacuum evaporator chamber. After getting the vacuum ~ 3.8 x 10^{-7} mbar inside the chamber, current was increased slowly up to 100 Amperes in steps of 10 Amperes with an interval of 2 minutes. After reaching at 100 Amperes, it was kept there for 15 minutes before stopping the evaporation. During the evaporation, the vacuum inside the chamber was maintained at ~10^{-6} mbar. After the evaporation, the chamber was left for few hours for the cooling and then vented it very slowly. Thickness of the deposited tellurium was measured using the surface profilometer. After the evaporation, it was seen that at the center of the target no material was deposited and to solve this problem the limit of maximum current was reduced from 100 Amperes to 70 Amperes. After reducing the current, material was deposited properly in the target.

Fig. 1 Setup used for the evaporation of ^{130}Te in High Vacuum Evaporator chamber at IUAC, New Delhi.

Results and Discussion

Four targets of enriched ^{130}Te with gold backing have been successfully prepared using the resistive heating method in high vacuum evaporator chamber at IUAC, New Delhi. To prepare all the four targets 40mg target material was utilized. To measure the thickness of the targets, their XRF measurements were done and they are listed in Table 1. Figure 2 shows the XRF spectrum of the enriched ^{130}Te target. These targets will be used in our proposed experiment in near future.

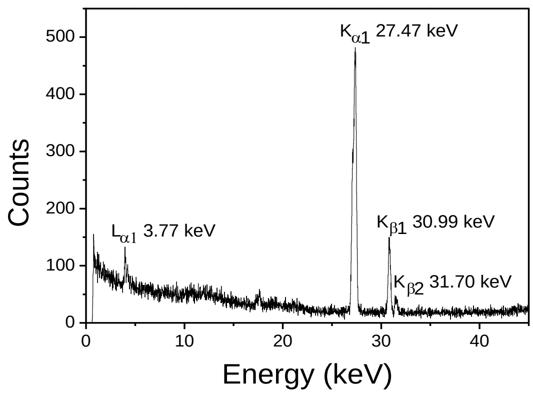

Fig. 2 XRF spectrum of ^{130}Te target

Table 1: Thickness of the all the fabricated targets.

Target	Thickness (mg/cm^2)	Au Backing Thickness (mg/cm^2)
^{130}Te	1.1	4.0
^{130}Te	1.2	4.2
^{130}Te	1.1	6.4
^{130}Te	1.2	6.6

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