Fabrication of ^{197}Au target using high vacuum evaporator facility at IUAC, New Delhi

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Introduction

With the availability of heavy ion accelerators it has been possible to study nuclear structure and nuclear reaction mechanism of heavy ion collisions. To understand the nuclear reaction mechanism in heavy ion collision, uniform and high Z target is required. The high vacuum evaporator facility of IUAC was used in the fabrication of an enriched ^{197}Au in the form of shots target on substrate of glass slides and soap solution as parting agent. Accurate determination of thin target thickness is quite important in nuclear physics experiment. In principle there are many methods for measuring foil thickness. Basically Alpha energy loss method, Quartz crystal method and step height techniques had been used for a comparative study of the differences produced.

Details of High Vacuum Evaporation Chamber

The evaporation of the shot of ^{197}Au target material on substrate of glass slides with soap solution as parting agent was carried out in High Vacuum Evaporator Chamber in the target laboratory of Inter University Accelerator Centre (IUAC), New Delhi, India. Vacuum of the chamber during the evaporation of ^{197}Au material on glass substrate with soap solution as parting agent was achieved and sustained of the order 10^{-6} mbar using diffusion pump. The target material was evaporated using the method of resistance evaporation technique. The evaporator was equipped with a quartz crystal thickness monitor, which gives the thickness of deposited material as well as the rate of evaporation on the crystal.

Procedure of Fabrication

In the first step, soap solutions was applied on the glass substrates . The slides with a layer of the soap solution was left to dry after which the layer of it was made even by polishing. The slides were mounted on the slide holder of the chamber. Several attempts were made in the deposition of ^{197}Au material on the glass substrate with soap solution as the parting agent to identify the right position of the substrate from the boat so that we may reach on the required thickness. After getting the required thickness using fewer amounts of the natural Gold shots, the distance between the substrate and boat was noted. The suitable distance of Dimple boat of Tungsten to substrate was found to be 15 cm.

After completing the testing the setting of all parameters and adjustment of vacuum chamber for the ^{197}Au material deposition has been done. The distance between Dimple boat and substrate was fixed at 15 cm. The Quartz Crystal monitor has been fixed on a distance 16 cm. ^{197}Au shot of density 19.3 and 6.35 mm semi-spherical shot has been put inside the dimple boat. Then, we achieved the vacuum inside the chamber $\sim 10^{-7}$ mbar using diffusion pump. The diffusion pump was started at the current of approx. 170 A in the resistive heating process. The deposition rate was sustained 0.1 nm/ sec for the uniform deposition of ^{197}Au. Deposition was stopped on reaching the required thickness of ^{197}Au material on glass substrate with soap solution as the parting agent. The thickness of the deposited ^{197}Au material was also verified by α-transmission method using ^{241}Am source. We have prepared 6 thin enriched ^{197}Au targets on glass substrate with soap solution as parting agent of thickness ranging from $\approx 300 - 400$ μg/cm^2 using the

vacuum evaporation technique from the very less amount of material.

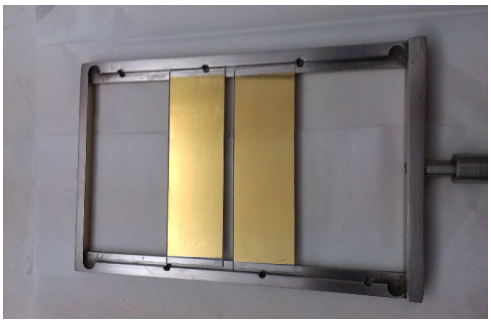

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Fig. 1: Substrate after the deposition of ^{197}Au on glass substrate with soap solution as parting agent.

a.

b.

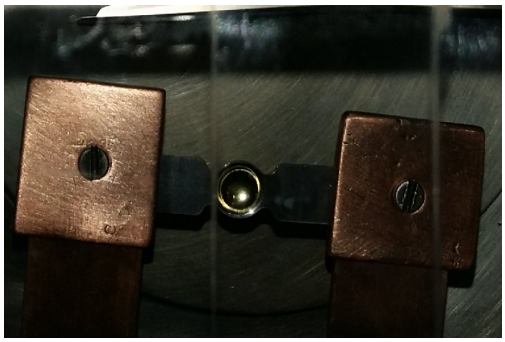

Fig. 2 (a): High Vacuum Evaporation setup for the evaporation of target material with Dimple boat.
(b) Dimple boat of Tungsten used for evaporation.

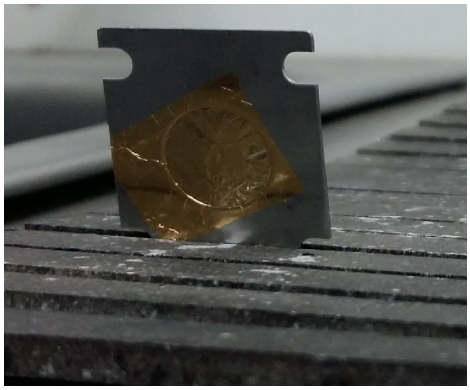

Fig. 3: Prepared targets of ^{197}Au. .

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