

A Method to Stick the High Voltage Lug onto the Grooves made on the Glass Electrodes

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A procedure of soldering high voltage lug onto the grooves made on the glass electrodes with the help of thin aluminium foil has been developed. The strength and stability of contact has been demonstrated successfully.

Introduction

Resistive Plate Chamber (RPC) detector was introduced in 1981 by R. Santonico and R. Cardarelli. It is a particle detector consists of two parallel glass electrodes of surface resistivity 10^{10} - 10^{20} ohms per square coated with graphite painting and gas gap of few mm. High resistivity of electrodes prevents high voltage supply from providing the electric charge which helps in discharge between electrodes. It helps in electric field drop drastically in the region of discharge causing it to extinguish [1]. The electrodes are connected with high voltage power supply. To create uniform electric field inside the gas chamber a thin uniform layer of graphite coating is done whose resistance is 100-150 kilo ohm. A gas mixture of Argon, Isobutane and an electronegative gas like Freon (R134a) are used inside the gas gap. Argon acts as target for ionizing particle. Isobutane helps in absorption of photon thus limiting the secondary avalanches. An electronegative gas serves the purpose of limiting the amount of free charge in the gas which can have high absorption coefficient for ultraviolet light. When a high energetic particle crosses the detector it ionized the gas in the detector and electron-ion pairs are produced, which give rise to an electrical signal that is measured.

While applying the high voltage through the electrical cables on the glass electrodes there is a possible problem of detachment of electrical cables from the surface of glass electrodes. In order to solve this problem we have developed a method, in which we attach a thin aluminum foil by a good adhesive on the glass electrodes at which the high voltage lug is soldered. This method is very effective and is also very cheap.

Experimental Details

The ways which we have tried in attaching these HV lug onto the glass plates are as follows:

- [1] One way is attaching the HV lug with suitable conducting glue that can attach the HV lug with glass plates.
- [2] Use adhesive copper tape to attach HV lug to the glass plates.
- [3] Attach Aluminum / Copper thin foil using any nonconducting glue on glass and solder the lug on this foil.

We have tried to prepare conducting glue in our laboratory by mixing graphite powder in different proportion in nonconducting glues like Araldite, Fevicol, Fevi kwik, Silicone gel etc. but these do not show any conducting behavior. We also tried using Silver paste and it showed desirable result. But we did not use it further due to its very high cost. We have also used adhesive tape to stick with the glass electrodes but this adhesive tape become loose after some period of time and it does not tolerate any significant external force and gets easily detached from the glass plate.

We have also worked on another method in which we have taken aluminum foil of different thicknesses (0.175 mm and 0.001 mm). We have used different types of glues like Araldite, Fevicol, Fevi kwik, Silicone gel etc to attach these aluminium foils on the glass plate. After wards we leave it for 24 hours so that it can stick properly. After 24 hours it is found that the aluminum foils attached with Araldite are in good condition. But others are easily detached, so we rejected them. Then we soldered the HV lug on Aluminum foils by using an "Ansol Aluminum Soldering Flux" and method described in paper of *M. K. Singh et al* in this proceeding. This soldering flux helps in better attachment of HV

lug on Aluminum foil. In doing soldering as shown in Figure 1, we have to take one precaution that no air bubble forms between aluminum foil and soldering material. Due to the cost effectiveness we only used and worked with the aluminium foil.

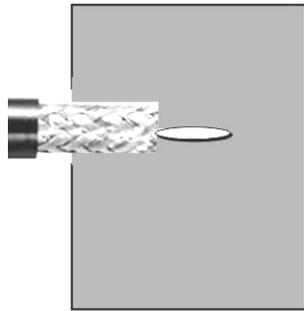


Fig. 1: Schematic diagram of soldering high voltage lug onto the grooves made on the glass electrodes of RPC detector.

After attaching the HV lug with glass plate, graphite coating has been done for final step in making the glass electrode active. But before coating, we have to measure the strength of soldering and attachment of foil on glass plate. To do this we have applied different weights along the vertical and horizontal directions of the contact point and measure the time up to which aluminum foil is attached with glass plate as shown in figure 2. We have measured the effect of pulling in both horizontal and vertical direction of glass plate.

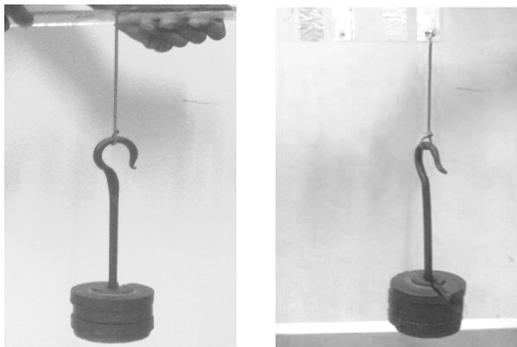


Fig. 2: We hang the weights in horizontal (Right) and vertical directions (Left).

Table 1 shows the time taken to tear off from the glass plate when weight is hanged in perpendicular direction of glass. During this measurement the temperature and relative humidity was ~ 25°C and 65%, respectively.

Thickness	Weight(Kg)	Time (hrs.)
0.175mm	3.0	03
0.175mm	2.5	03
0.175mm	1.0	04
0.001mm	3.0	12
0.001mm	2.5	13
0.001mm	1.0	12

Table 1: Parameters related to the strength and stability of contacts.

Conclusions

We found that the Araldite seems to be good adhesive for attaching the aluminum foil with glass plate. For drying the glue on the glass plate, 24 hrs seems to be reasonable time. We also found that the thinner aluminium foil is better one but less than micrometer thin aluminium foil is not good for soldering because it melts quickly. The developed procedure is cheaper and fulfills all the requirements of conducting glue.

Acknowledgment

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Reference

[1] Design and Characterization Studies of Resistive Plate Chambers Detector by S. Bheesette, Thesis (2009).