A method to solder contacts on the Aluminum surface of Pickup Strips of RPC Detector

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A procedure of soldering on the aluminium surface has been developed. The effects of various parameters have been studied that can affect the quality of soldered connection. There are no visible effects of heat observed.

Introduction

There is a common problem faced by all experimentalists in doing the soldering on aluminium surface for making proper and stable contact. This problem becomes very serious if any machine or detector will take data for very long time, since as time passes, the soldered wire is easily gets detached from the contacts made on aluminium surface. Because of this problem, it will be difficult to get the proper working of the pickup strip panel and therefore live time of data taking decreases and noise rate increases in the received signals induced by the Resistive Plate Chamber (RPC) detector. Our group is working to solve this problem in making contacts on the aluminum surface for the construction of pickup strip panels for the RPC detector. The basic reason behind the above mentioned problem is that a layer of aluminum oxide (Al_2O_3) is formed in the presence of moist air at the surface of aluminum sheet due to which proper soldering is not possible on it. If we remove the oxide layer by mechanical abrasion and use conventional flux under a very thin film of oil to keep the moist air away then the soldering problem can be removed.

Experimental details

In solving this problem, various methods have been developed for the soldering procedure and several fluxes were applied. We used Ansol aluminum soldering flux which was the cheapest and the best result achieved under a proper soldering process. But the composition of Ansol aluminum soldering flux is not well known for which chemical analysis is required.

Soldering process

To make proper contacts and almost permanent soldering of wires, the adopted procedure has a very important role. In soldering process a small drop of the aluminium flux is taken on the aluminium sheet and with a preheated soldering rod the soldering wire is melted and put on the drop of the aluminium flux. Then the surface of aluminium sheet is rubbed with the heated solder until the melted drop of solder wire starts spreading at that place. Now the connecting wire is placed at that place on the aluminium sheet and allowed to cool down.

Measurements

To check that the above mentioned process of soldering is working well or not, some tests are necessary to perform on it.

1. Effect of pulling

To check the strength of soldering, the soldered wire is placed under tensile stress within the elastic limit with the help of a string and hook, and enough force in terms of weight has been applied on it from the both directions i.e. along (vertical) and side wise (horizontal). For the soldering purpose different soldering iron rods of different (15, 125, and 250 watts) power have been used to check the effects of heat over the quality of soldered contact.

Fig. 1 Pulling in horizontal direction and vertical direction of soldered wire (from left to right)

All tests have been done using the same procedure and at constant room temperature and relative humidity, ~ 29°C and 68%, respectively.

Power of soldering Iron (Watts)	15	125	250
Amount of soldering flux used (drop)	One	One	One
Weight applied in horizontal direction (Kg)	12.0	12.0	12.0
Weight applied in vertical direction (Kg)	7.5	7.5	7.5
Results	Intact	Intact	Intact

TABLE 1: Test parameters and results.

From the above table one can see that the applied force has not affected the soldered contact. However the aluminium sheet starts detach from the dielectric material of the pickup strip panel. However, the soldered point/contact was still in shape and in position. In the case of horizontal direction the above case is also valid and sustaining more force.

2. Effect on signal

To see the effect in terms of the change in shape of signal and noise of flux used in soldering on the signal. An input signal from a function generator through a cable soldered at the Aluminum sheet is applied and output signal taken from the other end of the sheet by another soldered cable connected it with the oscilloscope.

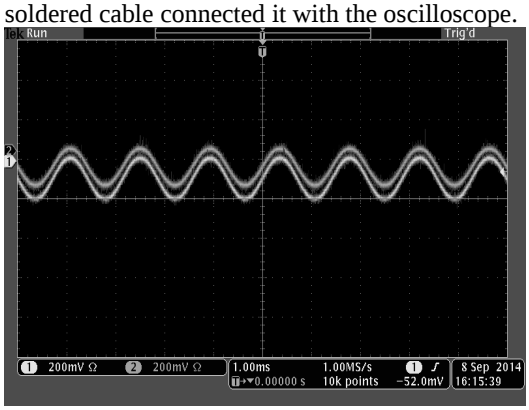

Fig. 2: Lower function is the input signal and upper function indicates output of the input signal.

From the Figure 2 one can see that both input and output signals have been merged into each other completely. It means that there are no reflection, attenuation, or termination and noise in the output signal.

3. Effect of heat

In the case of polycarbonate used as a dielectric material for the pickup strip panel having comparatively low melting point (155°C) can possibly get deformed through heat or long time heating. To understand the heating effects is therefore required. Microscopic inspections have been done before and after soldering the wire point. No visual effects in terms of melting, burning or deformation in the shape have been observed at the place of soldering in polycarbonate. Also to see the effect of heat on the soldering quality we have used three different powered soldering iron rods. But from the above table one can easily understand that there is no effect on the soldering quality.

Conclusions

The above mentioned problems in the soldering of wire on the aluminum sheet has been resolved with the help of above mentioned procedure of soldering with the Ansol aluminium flux. The signal quality is found to be not affected by the use of above procedure. It also does not seen to have any significant effect on quality of soldering heat, i.e. the power rating of the soldering rod. This procedure of soldering is found to be better, because it does not seen to affect the physical properties of dielectric material of pickup panel.

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Reference

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