Efficiency and Cross-talk Studies of RPCs

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Introduction

We present the studies undertaken related to the Resistive Plate chambers (RPCs) [1], the active detector [2] components of the magnetised Iron CALorimeter (ICAL) experiment at India based Neutrino observatory (INO) [3]. ICAL will help us in measuring the oscillations parameters in atmospheric muon neutrinos, matter effects in neutrino oscillations, sign of δ_{23} using matter effects.

So, at present the parameters of the RPC have been optimised in order to obtain a criteria that can be used for the better performance of RPCs [4]. Some initial results like tests done to obtain the properties of glass and efficiency and cross-talk of fabricated RPCs would be presented here.

Results

These studies include the characterization of the glass, used as an electrode in the RPCs, based on its various properties like physical, electrical, surface, optical, UV-transmittance, elemental analysis (Pixe, WD-XRF). The electrode glass is an important factor in the ageing of RPCs. Characterization of glass can help to find possible reasons for ageing of RPCs. So, the different samples of glass of different manufacturers (Saint Gobain, Asahi, Modi) were procurred from local market. The results were compared first and then concluded, which glass samples should be used in the fabrication of RPCs. Fig. 1, 2, 3 shows the elemental analysis of the Asahi, Saint-Gobain and Modi glass using pixe technique (Cyclotron facility at PU, Chandigarh).

Pixe results were further confirmed with WD-XRF analysis. The main component of glass was found SiO_2. But, the presence of other components were also obtained.

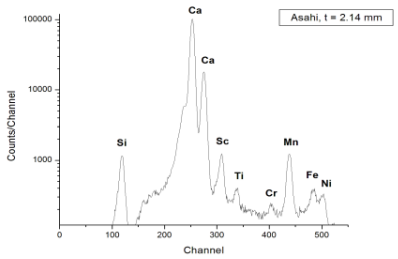

Fig. 1 Elemental analysis of Asahi glass using pixe technique.

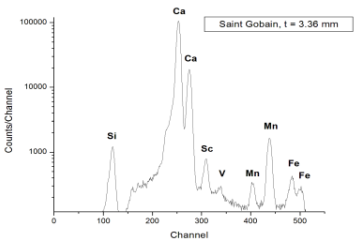

Fig. 2 Elemental analysis of Saint Gobain glass using pixe technique.

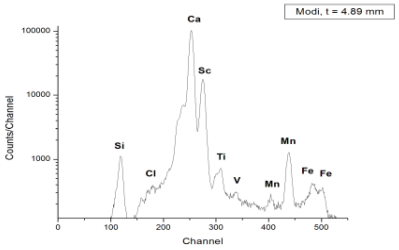

Fig. 3 Elemental analysis of Modi glass using pixe technique.

Then, fabrication of the glass RPCs was done on the basis of the tests performed. The performance of these fabricated RPCs was checked from the studies of their efficiency and cross-talk with respect to the change of strip-width of pickup panels (panels to get signal from RPC) used. The results and conclusions of these studies would be presented establishing the selection criteria for the glass and the strip width for the maximum efficiency outcome from the RPCs. Fig. 4, 5, 6 shows the efficiency and cross-talk of the Asahi, Saint-Gobain and Modi glass with strip width = 2.8 cm. High cross-talk is due to the misalignment of the scintillator paddles (used to trigger RPCs) and use of only two gas Freon (R134a) and Iso-butane (no SF_6 gas used).

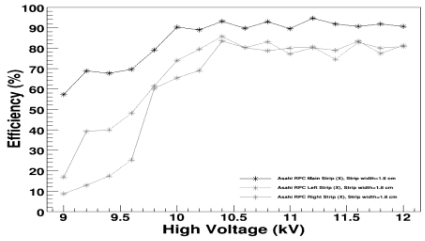

Fig. 4 Efficiency and cross-talk of Asahi glass RPC with strip width = 2.8 cm.

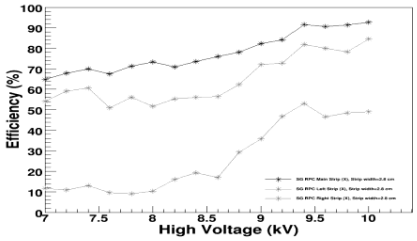

Fig. 5 Efficiency and cross-talk of Saint-Gobain glass RPC with strip width = 2.8 cm.

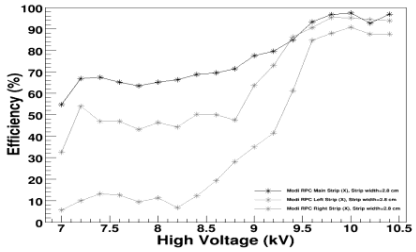

Fig. 6 Efficiency and cross-talk of Modi glass RPC with strip width = 2.8 cm.

Hence, the optimization of the parameters like quality of glass and strip width to be used is done with our studies.

References

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