

Aging Study for BESIII-type RPC and New development of Bakelite electrode

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Following the invention of the Resistive Plate Chamber (RPC) more than 29 years ago¹, RPC systems with two major types of Bakelite electrodes have been used in L3 and BaBar, and are presently being used by CMS, ATLAS, STAR, ALICE ToF, and a variety of cosmic ray and neutrino experiments, such as ARGO-YBJ, OPERA and Daya Bay.

In recent years the BESIII Muon group of IHEP (Beijing), together with Gaonengkedi, Inc. (Beijing), have developed a new type of Bakelite, used in the BES III2 and Daya Bay Muon Systems, that does not require linseed-oil treatment for the RPCs to achieve acceptably low dark-noise rates. These RPCs are operated in streamer mode in their present applications. The ILC Hadron Calorimeter and Muon Detector System have expressed strong interest in adopting this technology for their active detector candidate. However, aging of the BESIII-type RPCs has not been thoroughly studied, and there is no published report available on this topic. Here, we summarize some preliminary aging studies of BESIII-type RPCs to be used in the Daya Bay Muon System. The test results indicate a significant aging effect that must be understood and mitigated prior to use of this technology in accelerator experiments, where the background particle rate is not negligible.

Detailed microscopic study on the surface morphology of the Bakelite electrodes before and after the aging clearly reveal the direct evidence of HF corrosive action on the white surface of BESIII-type Bakelite electrodes. Although such corrosive action has been suspected for several years, the linseed-oil coating on the dark-colored and/or marble-patterned Italian Bakelite surfaces has made optical microscopic study of the surface morphology difficult.

Our study confirms the role of linseed-oil coating in protecting Bakelite from HF etching. To suppress the aging of future BESIII-type RPCs, a new procedure to integrate a linseed oil coating into the Bakelite production is being developed³, and the aging performance of samples of this new form of Bakelite is under intensive test. In this report a brief summary of these tests, and further R&D plans, will be presented.

¹ R. Santonico and R. Cardarelli, Developemnt of Resistive Plate Counter, NIM 187 (1981) 377

² J. Zhang et al., Nucl. Instr. and Meth. A 540 (2005) 102

³ This new material is produced by Xianhu Construction Material, Inc. Beijing.

Primary author: Mr LU, Changguo (Princeton University)

Presenter: Mr LU, Changguo (Princeton University)

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