Influence of Materials and Sense Wire Surface Quality on Aging with DME and Other Gases

(title assigned)

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Different methods of aging-rate measurements for wire chambers were analyzed and a more correct procedure was proposed. Using this procedure the gain and gas flow rate dependence of the aging rate with dimethylether (DME) was measured. A study of aging with DME argon/carbon dioxide and carbon dioxide/isobutane was performed. The influence of the drift chamber construction materials, gas seal pastes and tubes on the aging rate has been investigated. The radiation hardness of the KEDR drift chamber cell with DME was increased by an order of magnitude by careful selection of drift chamber and tubing materials. The influence of preliminary irradiation of the counter with pure DME gas in relatively clean conditions on the aging rate was studied. Under continued irradiation of the same part of the sense wire with contamination in the gas from certain materials a zero aging rate was observed up to a charge collected per unit length equal to 0.2 – 0.3 C/cm depending on the dose of the preliminary irradiation. Then the amplitude started to drop but the aging rate measured for this part of the sense wire is smaller in comparison with non-irradiated one. The influence of the sense wire surface quality on aging properties was investigated; a model for the creation and growth of films is proposed to explain these results.

Summary of Talk: It was found that the commonly used procedures for aging rate measurement have big systematic errors. A new, more correct procedure for aging rate determination was proposed. Using this procedure DME gas as a candidate for the drift chamber of the KEDR detector has been tested under laboratory conditions, with control of purity, materials, plumbing, etc. Also some previously known gases have been investigated compared with DME under the same conditions. Special emphasis has been given to the test of our DME gas, and the conditions necessary to maintain good stability. Under relatively clean conditions, very good stability against aging was found with the proportional tube. It is found that the aging rate of this gas is very sensitive to contaminations from the materials in the gas stream. The influence of the different DC construction materials and gas seal pastes on the aging rate has been investigated. Studies were made of the various types of tubing commonly used for the plumbing. Teflon and two type of PVC tubing were tested, and only the PVC tubing used in medicine did not exhibit aging effects. An investigation of two types of oil vapors showed negligible influence on aging. The gain and gas flow rate dependence of the aging rate with DME was measured. The influence of preliminary irradiation of a counter with pure DME gas in relatively clean conditions on the aging rate was obtained. Under continued irradiation of the same part of the sense wire with contamination in the gas from some materials zero aging rate was observed up to a collected charge of 0.2 – 0.3 C/cm depending on the dose of preliminary irradiation. Then the amplitude started to drop but the aging rate measured for this part of sense wire is two times smaller in comparison with the non-irradiated one. The influence of the sense wire surface quality on aging properties was investigated and a model for the creation and growth of films is proposed for the explanation of these results.