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Drift properties of electrons in gases

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The drift properties of electrons in gases under the influence of a homogeneous electric field are characterized by three transport coefficients: the drift velocity, and the longitudinal and transverse diffusion. We have been able to show that starting from the precise measurement of two of these coefficients one can determine the microscopic parameters relevant for the solution of the Boltzmann transport equation. Using this technique the microscopic parameters have been determined for all noble gases and some organic gases. Starting from these values the drift velocity and diffusion can be calculated for any mixture of these gases. The agreement between the calculated and measured values is excellent and in the order of the reproducibility of the measurements (less than 1% for v_D).

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A Laboratory Study of Radiation Damage to Drift Chambers

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Radiation damage to Ar/C_2H_6 and $Ar/CO_2/CH_4$ filled wire drift chambers is studied in controlled laboratory tests both at KEK and MPI aiming at quantitative chamber lifetime estimates. In both gas mixtures stable operation in proportional mode and for Ar/C_2H_6 also in the limited streamer mode is possible up to collected charges of a few times $10^{17}e^-$/mm. Gain reductions of $\lesssim$ 1%/$10^{16}e^-$/mm for Ar/C_2H_6 and of 0.5 to 3.5%/$10^{16}e^-$/mm in $Ar/CO_2/CH_4$ are observed depending on details of the test set up and parameters. Gain nonuniformities lead to considerable distortions of the Fe^{55} 5.9 KeV γ line. The effect of H_2O and organic vapor from PVC surfaces on aging rates is studied quantitatively.

SEM analyis showed that the observed gain variations are caused by poorly conductive surface coatings of the aged anode wires containing C as the dominant chemical element. Other elements found by X-ray fluorescence are O, Si and - in the case of $Ar/CO_2/CH_4$ - also Cl and S.

Spark and glow discharges in Ar/C_2H_6 immediately lead to "whisker" growth and black deposits containing C as the only detectable element on anode and cathode wires. In contrast discharges in $Ar/CO_2/CH_4$ for up to 30 min do not result in any detectable deposits.