

A GAS IONIZATION CHAMBER
FOR COMBUSTION GASES IDENTIFICATION

R. Tasić

Institute of Nuclear Sciences "Boris Kidrič", Beograd

The problem of the ionization current flowing through a gas subjected to a continuous high radiation intensity can be solved by using various approximative methods. The collection efficiency for the plan parallel geometry is given in the following equation¹⁾ (if we denote collection efficiency by f)

$$f = \phi \left(\frac{d^2}{V} \sqrt{q} \right) \quad (1)$$

The form of the curves is given by ϕ and it has to be determined experimentally depending on the used gas, the temperature and pressure. In the above relation d stands for electrode distance, q is the ionization intensity, and V the collection voltage. Moreover, the form of function ϕ depends only on the mobilities and recombination coefficients.

Two series of measurements were undertaken. In the first, the electrode spacing and the ionization intensity were held constant at room temperature and normal pressure and saturation curves were taken for different gases. The collection efficiencies for some of these measurements are plotted a base of collecting voltage in Fig. 1. too, and it can be seen that there is a great discrepancy between of combustion gases and other gases. This discrepancy is used for combustion gases identification and it can be observed in a great number of measurements.

In a single ionization chamber there are numerous instability problems related to electronics, pressure, temperature and leakage currents because of the operating periods. That is the reason why the differential ionization chamber²⁾ was used as the gas detector. There are additional advantages to be gained by the differential method. The possibility of varying parameters on the r.h.s. of Eq.(1) enables us to obtain the wanted ionization current. Owing to the polarities of the chamber the two currents do compensate, and a net current of wanted sign and intensity can be obtained. In the second series of mea-

surements using a differential chamber, the ionization current of one chamber was held approximately constant, whereas the gas

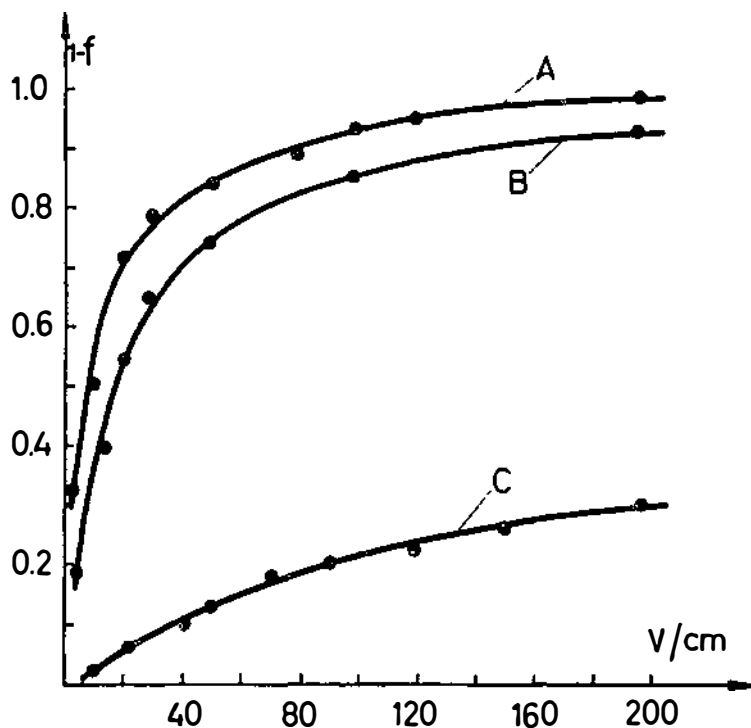


Fig. 1. General saturation curve for A-Air, B-CO₂, C-Combustion

content of the other chamber could be changed, i.e. the form of function ϕ . A device of current amplification for low current measurements was used³⁾. The response of the system is approximately linear in net ionization current for the concentration of combustion gases.

REFERENCES

- 1) J. W. Boag and T. Wilson, *Brit. J. Appl. Phys.* 3 (1952) 222.
- 2) D. A. Walker and H. T. Easterday, *Nucl. Inst. and Meth.* 48 (1967) 277.
- 3) B. Ćirilov, M. Šmelcerović, D. Novković, *Mehanizacija i Automatizacija* 16 (1970) 16.