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NOTE

Influence of Gas Pressure on the Threshold Potential in Hydrogen Sulphide

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The influence of gas pressure p on the threshold potential V_m has been studied in hydrogen sulphide gas under ozonizer excitation. Vm has been found to increase with p.

Studies of the influence of gas pressure p on the threshold potential V_m, where a gas/vapour breaks down as a dielectric, in air[1] and nitrogen[2] have revealed that V_m varies linearly with p; whereas the curve V_m *vs.* p in argon[3] is concave towards pressure axis and in hydrogen[4]; V_m first decreases then increases with p as in argon. It was of interest, therefore, to study the same in hydrogen sulphide.

The glass assembly used and the electrical circuit employed were the same as reported earlier.[5, 6] Hydrogen sulphide was prepared by the action of aqueous hydrochloric acid on pure iron sulphide. It was first bubbled through distilled water and then dried over $CaCl_2$ and P_2O_5 tubes. The dry gas was finally passed through a gas tap kept immersed under liquid air. Thus, purified hydrogen sulphide was admitted into the annular space of the Siemens type, acid-treated, baked at 200°C while under vacuum, an all-glass ozonizer at the desired pressure at room temperature 30°C. Threshold potential V_m was determined from the corresponding current-potential characteristics in dark.

Fig. 1 shows the variation of the threshold potential with the ga pressure p of hydrogen sulphide. The concavity of the curve towards V_m-axis indicates that the behaviour of hydrogen sulphide under discharge is different from that of air, nitrogen, argon and hydrogen referred to above.

A self-maintained low-frequency electrodeless discharge is struck in a gas/vapour confined in a tube when the applied potential V equals or exceeds the corresponding minimum threshold potential[7, 8] V_m. The Townsend condition[9–11] for a self-maintained discharge is

$$\alpha/\beta \; (= 1/r = \alpha/\eta\theta g) = e^{\alpha\delta}$$

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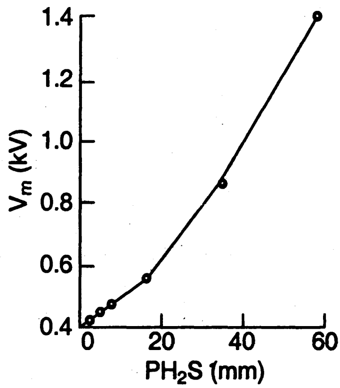

Fig. 1. Pressure variation of the threshold potential in hydrogen sulphide.

where α is the first Townsend coefficient for ionization by electron impact, β the second coefficient interpretable in terms of r or an $\eta\theta g$ signifying secondary liberation of electrons at the cathode by positive ion bombardment or as a photoelectric process due to photons generated in the gas and δ the electrode separation. For each ion created in the gas by ionization by electron impact, there are created by secondary processes at the cathode enough electrons to maintain $re^{\alpha\delta}$ at its existing value. With metal electrodes immersed in the gas, the secondary electrons can be identified with the Fermi electron gas in the metal. No such simple mechanism suggests itself, in the first instance, for discharge with dielectric, *e.g.*, glass surface exposed to the gas. For ionization to take place, the energy per mean free path must exceed a certain minimum amount—the ionization potential of the gas. So, a high potential will be necessary at a high gas pressure as observed in the present investigations.

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