The Microtron

THE microtron which has been under construction at this College is now operating and accelerates electrons to an energy of 29 MeV., which is slightly greater than the design figure. The poles of the electromagnet are 80 in. in diameter and form the top and bottom of the vacuum chamber. The machine operates in the fundamental mode with a 2 MW. pulsed radio-frequency supply, of frequency 3,000 Mc./s. The current in the final orbit (57th) is about 10^{-9} amp. average and it should be possible to increase this considerably by fitting an emitting ring into one of the lips of the cavity. Due to the very close machining tolerances achieved by Edgar Allen and Co., Ltd., it was found that very little shimming of the magnet was required.

The electromagnet has been designed to run at higher fields than those used at present (approximately 1,000 oersteds) and it is hoped to develop a modified cavity resonator which can utilize this fact to increase the final energy of the beam.

The proposed experimental programme includes the study of bremsstrahlung spectra and the determination of the rate of energy loss of electrons in various materials.

A fuller account of this machine is to be published elsewhere.

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Influence of the Ambient Medium on the Breakdown Voltage of Sheet Insulating Materials

IT is common experience to find that the values of electric strength of sheet insulating materials are lower when the measurement is made with the material immersed in oil than when the specimen is tested in air. This is usually explained by stating that the voltage for inception of discharge is higher in the liquid because of the higher electric strength of the liquid, so that when discharges do occur in this medium they are more intense and hence more damaging because of the higher voltage-drop across the discharge channel.

This reasoning was investigated by the measurement of 50-c./s. breakdown voltage of films of cellulose triacetate and polyethylene terephthalate in air over a range of pressures from that corresponding to rough vacuum up to about 8 atmospheres. The electric strength of the air, therefore, was arranged to pass through a value equal to that of transformer oil.

It was found, contrary to expectation, that the breakdown voltage of the film specimens increased as the pressure, and hence the electric strength, of the air increased. The nature of the gas medium, however, was found to influence the electric strength markedly as the curves in Fig. 1 show, the highest electric strength being recorded when helium was used and the lowest when argon was used. Each point in the graph is the mean of three or more observations.

The tests were made at room temperature, a sphere/plane electrode system being used. A step-by-step method of voltage application was employed to give results equivalent to the 'one minute' value.

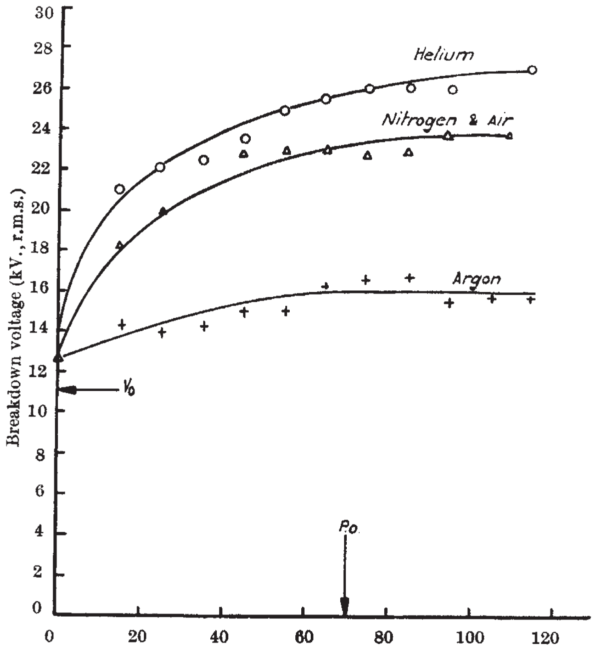

Fig. 1. Breakdown voltage of 8-mil cellulose triacetate with ambient gas pressure: V_0, mean breakdown voltage in transformer oil; P_0, approximate pressure at which the electric strength of air equals that of transformer oil

It is hoped that an explanation of these results will be published when the phenomena have been more fully investigated.

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Strength of Glass Fibres

W. F. THOMAS recently pointed out[1] that E glass fibres in the size range 0·0002–0·0006 in. had a very consistent strength of 540,000 lb./in.², when tested on a 1-in. gauge length. This is equivalent to an elastic failing strain of about 5 per cent. Other workers have found the strength of untouched glass fibres drawn in a similar way to be lower and more variable, depending on the conditions under which the fibres were formed[2,3].

From strength tests carried out in these laboratories and other evidence (to be published), it is concluded that there can be a genuine variation of strength which does not conflict with Thomas's results. Fibres of soda glass $X8$ drawn either from a rod or from a melt in a platinum container gave the following results. All the fibres were 0·001 in. in diameter and drawn at 37 ft./sec. The results given in Table 1 are stated in terms of percentage elastic failing strain.

In the tensile tests fifteen fibres were tested untouched within about an hour of formation. The fibre samples for the bending tests showed no difference in strength after several days exposure compared