LETTERS TO THE EDITOR

EFFECT OF HIGH-FREQUENCY VOLTAGE ON DIELECTRIC CONSTANT OF SPACE CONTAINING ELECTRONS

PRASAD AND VERMA[1] while investigating the applicability of Eccles-Larmor expression for the dielectric constant of electronic medium inside a Phillip A 442 Valve observed that the dielectric constant of such a medium depended upon the magnitude of the impressed high-frequency voltage, the anode and the screen-grid of the valve forming the plates of the experimental condensor. They observed that there was a parabolic relation between the change of capacity of the experimental condensor and the magnitude of the high-frequency voltage. Khastgir and Choudhury[2] also noticed this dependence, but did not confirm this parabolic relationship. Khastgir suggested that the observed effect was due to the fact that the effect of high-frequency voltage is to alter the amplitude of the electrons in the anode screen-grid space. For smaller values of voltage, electrons may not be able to reach the anode surface and for such conditions the conductivity of the space must be small and hence the equivalent shunt resistance high. With the increase of high-frequency voltage, this resistance would gradually fall and after some time, it will come to a constant value. As the effective change of capacity depends upon the conductivity of the space, the variation of the latter will explain the experimental results.

The present work was undertaken to study the subject in greater detail with a view to clarify the exact reason leading to this dependence. This was considered desirable specially in view of the fact that there is no room for the magnitude of high-frequency voltage in Eccles-Larmor expression. The present author has repeated the experiments of Prasad and Verma by using the same method with some improvements taking into account conductivity corrections. He has not been able to obtain any parabolic variation and the experimental curves obtained by him are essentially of the same type as those obtained by Khastgir and Choudhury. One typical graph is given in Fig. 1.

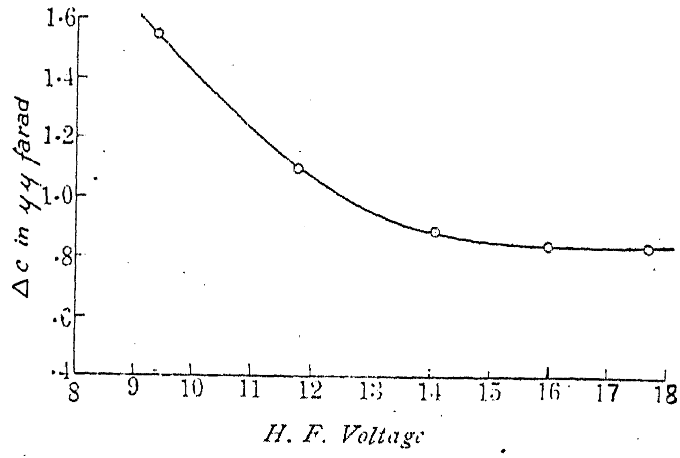

FIG. 1

λ = 110 metres. $i = 125 \times 10^{-6}$ amp.
Phillips B 442 valve

It is noticed that the anode current alters with the change in the magnitude of the high-frequency voltage. As the high-frequency voltage gradually increases, the anode current also gradually increases until a stage comes when there is no further change in the current with the increase of high-frequency voltage. The nature of variation is shown in the graph given in Fig. 2.

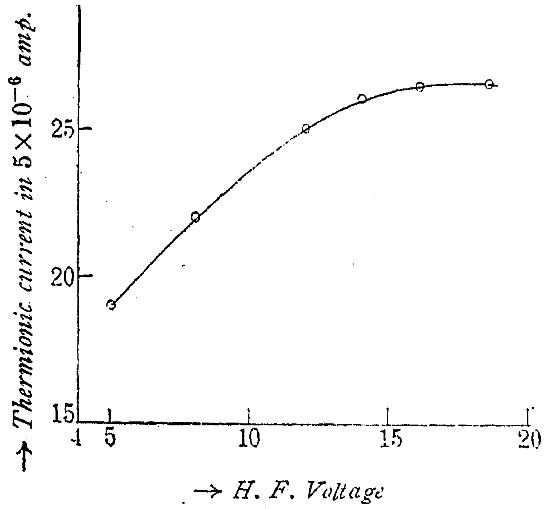

FIG. 2

Variation of Thermionic current with H. F. Voltage

Thus it seems likely that there is no dependence of dielectric constant on the high-frequency voltage, but the effect observed is of a secondary nature. The high-frequency voltage alters the magnitude of the anode current, but in our experiments and those of previous workers, the anode current was maintained constant by altering only the filament resistance. This procedure certainly altered the effective value of the electronic concentration between the condensor plates. This fact is further strengthened by the observation that the thermionic current begins to assume constant value at that high-frequency voltage where the change of capacity tends to become constant (compare Fig. 1 and Fig. 2).

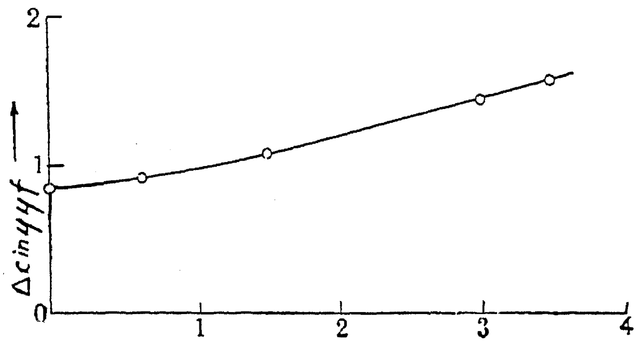

FIG. 3

Change in Thermionic current (in 5×10^{-6} amp.) due to application of H. F. Voltage

To bring out the relationship more clearly Fig. 3 has been drawn between the change of thermionic current due to impressed High Frequency Voltage and the change of capacity observed. The figure reveals that at least partially the observed change in capacity is due to change in electronic concentration consequent upon the introduction of High Frequency Voltage.

In conclusion the author thanks the Government of Bihar for the kind award of a scholarship during the tenure of which this piece of work was undertaken. The author is also thankful to Prof. S. P. Prasad and Dr. B. N. Singh for constant help and guidance throughout the investigation.

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1. Prasad and Verma, *Zeits. f. Physik.*, Band **99**, **7** and 8 heft, 107. 2. Khastgir and Choudhury, *Indian Journal of Physics*, 1940, **14**.

THE RARE OCCURRENCE OF MELILITE-DIOPSIDE-NEPHELINE ASSOCIATION IN A CALCIPHYRE, NEAR NANJANGUD, MYSORE

IN my present detailed studies of the Charnockite rocks in Mysore, while re-examining the micro-sections of some specimens of re-crystallised calc-granulites (Caliphyres) I had collected near Nanjangud in 1923, I recently noticed in one of them a mineral—which, from its optical characters and micro-chemical tests —I recognise as Melilite. A careful examination of the several specimens I had previously collected in the area discloses that Melilites, of varying optical characters, occur in a narrow band of garnetiferous-hornblende diopside granulite,—a component of a thin composite series of calc-granulites which are injected and veined by a later set of pegmatite. Melilites—presumably of varying composition—where found, are intimately associated with diopside, or zoisite and epidote; and are seen either as separate stout laths or in intergrowth with the one or the other of its associated minerals. One of the specimens of these granulites discloses in addition, large plates of nepheline enclosing, poikilitically, several coarse grains of diopside and granular sphene. Scapolite, lime, alumina, garnet, sphene, epidote, and some unidentified rare types of lime silicate minerals are also found in some of the specimens of highly calciferous types.

The occurrence of Melilite and Nepheline in these Calciphyres, is not only of great interest as the first recorded discovery of these minerals in Mysore, but their close association with diopside would throw some light on their paragenesis and on the mode of origin of the melilite rocks which, at least so far as this area is concerned, seem to have been formed from re-actions between an older impure dolomitic limestone and the later injected alkalic liquids connected with the granitic intrusions of the region. A full description of these melilite-bearing rocks, which are still under a detailed study, will be given in Volume XLI, *Records of the Mysore Geological Department*, which will be published in the course of a few months.

Mysore Geological Dept.,
Bangalore, B. RAMA RAO.
January 27, 1943.