mobilities follow the law of mixtures holding for non-reactive gases, as well as experimental uncertainties will permit. They give no ground for the suspicion that a very rapid aging takes place for ions in C_2H_2. Whether the theory of Erickson is correct or not is not indicated by these results. They merely remove some of the difficulties encountered in C_2H_2. A study of many other gases is needed, especially those where the negative ion has a lower mobility than the positive ion. The theory is liable to criticism from a theoretical point of view for it does not allow any latitude for the influence of the action of the electrical field of the ion on molecules on the mobility. The action of the field of the ion is assumed merely to cause the clustering. Whether or not the former effect, which must be present, can be included in the theory without seriously changing it, remains to be seen. It has not been needed thus far in accounting for the observed experimental facts which it has had to explain and has perhaps, therefore, been omitted.

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*CURRENT DISTRIBUTION IN SUPRACONDUCTORS**

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Read before the Academy April 26, 1927

W. Tuyn and H. Kamerlingh Onnes have published[1] an account of experiments carried out at Leiden on "The disturbance of supraconductivity by magnetic fields and currents." Part of this work constituted a rather crucial test of the hypothesis, suggested some years ago by the present author,[2] that the "critical current" observed in the early experiments on supraconductivity was merely that at which the magnetic field due to the current itself is equal to the critical magnetic field. In view of the ingenuity of the method and the carefulness of the experimental work, their results seem to deserve a somewhat more quantitative analysis than that given by the experimenters themselves.

The experiments here discussed were measurements of the potential difference between the ends of a slender tube of tin when currents were flowing both in the tube itself and in a wire stretched along its axis, but insulated from the tube. The specimen could be held at a temperature below that at which supraconductivity appears and the currents flowing in the tube and in the central wire could be adjusted independently to any desired values.

Let us assume that the tube is symmetrical and of homogeneous isotropic material and that, at the temperature of the experiment, it shows a definite critical magnetic field, H_c. By this is meant that material located where the field intensity exceeds H_c shows normal electrical resistivity while material located where the magnetic field is less than H_c shows the infinite conductivity exhibited by supraconductors cooled below their critical temperature. On these assumptions it is possible by a simple but rather laborious process to compute the potential difference between the ends of the tube for any given values of H_c and of the currents in the conductors.

These computations show that there will exist in the cross-section of the tube a number of zones in some of which the material will have normal resistivity while in others it may be supraconducting. In many cases the supraconducting layer shrinks to a current sheet of infinitesimal thickness but carrying a finite current.

In the experiments of March 12, 1924, the currents in the tube and in the wire were held constant while the temperature was varied through the critical range. In the first experiment current flowed in the outer tube only. In the second experiment the current in the inner wire was kept equal and opposite to that in the tube. The theory based on the above assumption indicates that the potential difference should finally vanish at the same temperature in both experiments, and that for a tube of the wall thickness used, the potential difference under conditions intermediate between full resistance and supraconduction should not differ in the two cases by more than 4 per cent of that corresponding to normal resistivity. The experiments showed no difference so great as 4 per cent between the two cases.

In the experiments of April 17, 1924, the temperature and the current in the tube were held constant, while the current in the inner wire was varied. For this procedure the analysis indicates that the graph of potential difference versus current in the inner wire would show a decrease to a minimum value followed by linear increase to the value corresponding to normal resistivity. For large values of current through the tube or high temperatures the curve should be V-shaped and the minimum potential difference might be considerable. For smaller currents or lower temperatures the curves should be U-shaped and the potential difference should vanish over a certain range of current. Curves of both types were obtained in the experiments, and the slopes of the linear portions of the curves are in good quantitative agreement with the theoretical slopes.

It may, therefore, be concluded that the results of these experiments can be completely accounted for by the assumption of a critical magnetic field, without making use of the concept of critical current.

* Published by permission of the Director, Bureau of Standards, Department of Commerce. A more extended paper on this subject will appear as a scientific paper of the Bureau of Standards.

[1] *J. Franklin Inst.*, **201**, p. 379, April, 1926.

[2] *Bur. Standards Sci. Paper*, No. 307, 1917.

ON THE REFLECTION OF ELECTRONS FROM CRYSTAL LATTICES

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Communicated May 31, 1927

(*a*) *Introduction.*—Davisson and Germer[1] have recently published their very interesting results on reflection of electrons from a single crystal of nickel. These results have been interpreted by analogy with the reflection of X-rays from crystals. This analogy, however, is not complete. The purpose of this short note is to point out the differences between the two phenomena. For the mathematical treatment use is made of the recent development of quantum mechanics (wave mechanics).

It is easy to see that a very important difference between the scattering of X-rays, as compared with the analogous phenomena for electrons, lies in the following fact. The scattering of slow electrons (of the order of 100 volt) is, crudely expressed, much more intense than that of X-rays. Indeed, one layer of atoms on the surface of a crystal may already deflect so considerable a part of an impinging beam of electrons that the effect can easily be observed. For ordinary X-ray scattering the effect produced by one layer is negligible and does not give an observable interference pattern. Only the coöperation of a large number of layers produces interference under the proper circumstances (Laue spots, Bragg reflection). We thus have the following difference. The interference pattern for X-rays is due to the action of a great number of lattice planes of a crystal, because of the small scattering coefficient of one layer. For the electrons, on the other hand, we have to expect that the action of a few layers on the