Summary

The double refraction of oxide films on Al conditioned by an electrolytic treatment of the metal in oxalic acid, sulphuric acid and so on ("Eloxal"-layers) is due only to the disperse structure of the film ("Formdoppelbrechung"), since the substances the film consists of are optically isotropic.

The optical properties depend, excepting the formation conditions, in a very characteristic manner on the crystallographic orientation of the metallic surface.

Measurements on the Electrical Resistivity of Thin Nickel Films

Some months ago we published in Nature[1] a preliminary note in which we reported measurements on the electrical resistance of thin nickel films. These films were obtained by cathode discharge, and the experimental technique for the production and the mounting of the films were published by us in Physica[2].

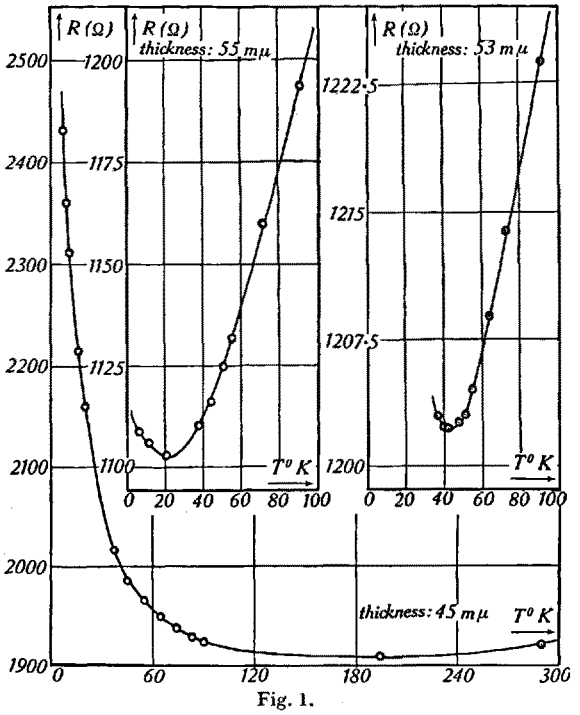

Fig. 1.

In our paper published in Nature we drew attention to some peculiar properties that those thin films possess. Below a certain thickness (about 40 mμ) the temperature coefficient for the electrical resistance was negative from low up to ordinary temperatures, and the films thicker than 40 mμ possessed a minimum (see Fig. 1) depending on their thickness. COLOMBANI[3] has also found a negative temperature coefficient for a thickness less than 220 mμ. On the other hand DE HAAS and VAN DEN BERG[4] published some years ago measurements of the electrical resistance of gold wires which show at liquid helium temperatures a minimum of the same type as our nickel films. Recently SHALYT[1] reported measurements on bismuth wires and found a minimum in the resistance curve at 4° K. Discussing these different experimental results we were inclined to believe that the observed phenomena are produced by a size factor for the respective conductors.

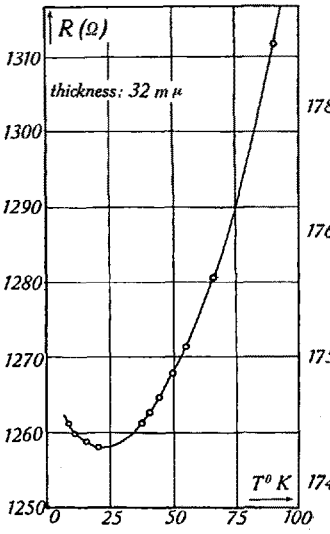

Fig. 2.

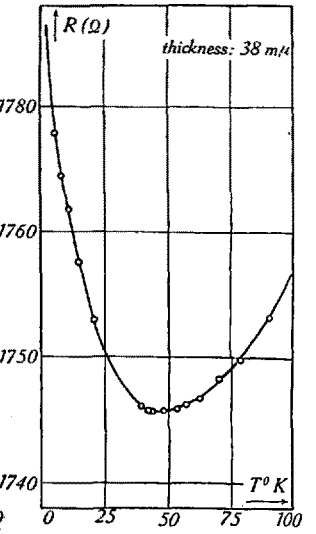

Fig. 3.

Recently we made new measurements, and we were a little deceived by these. The place of the minimum for the resistance curve as a function of the thickness seems not to be so well reproducible as we believed before. It depends strongly (see Figs. 2, 3, 4, and 5) on the experimental conditions of formation of the films. We observed further that when those films are heated the minimum is displaced to lower temperatures and finally disappears completely (Figs. 6*a*, 6*b*, and 6*c*).

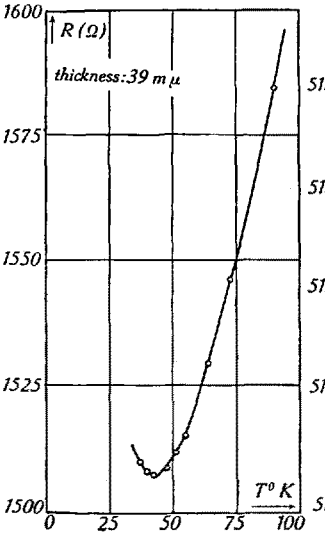

Fig. 4.

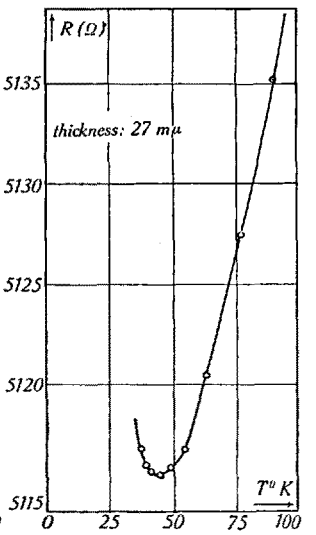

Fig. 5.

[1] A. VAN ITTERBEEK and L. DE GREVE, Nature 158, 100 (1946).

[2] A. VAN ITTERBEEK and L. DE GREVE, Physica *11*, 78 (1944); *11*, 465 (1946); *11*, 470 (1946).

[3] A. COLOMBANI, Ann. Phys. *19*, 272 (1944).

[4] W. J. DE HAAS and G. J. VAN DEN BERG, Physica *3*, 440 (1936); *4*, 663 (1937).

[1] S. SHALYT, J. Phys., Moscou, *8*, 315 (1944).

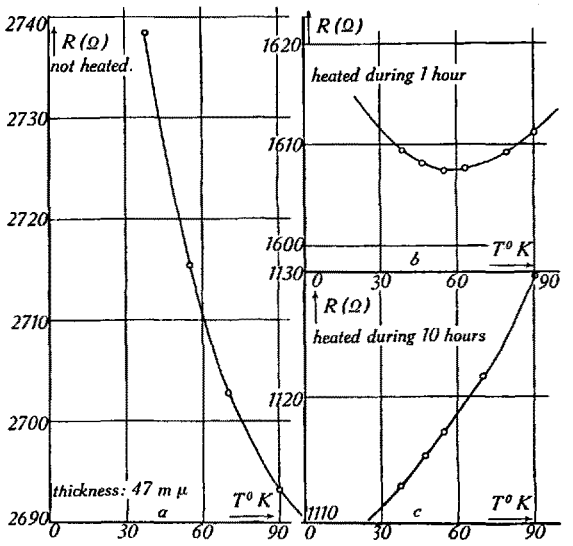

Fig. 6 *a*, *b*, *c*.

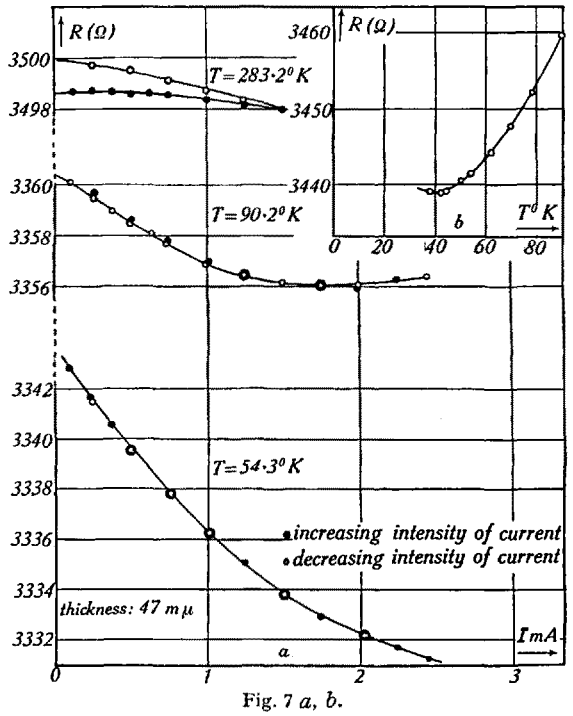

Fig. 7 *a*, *b*.

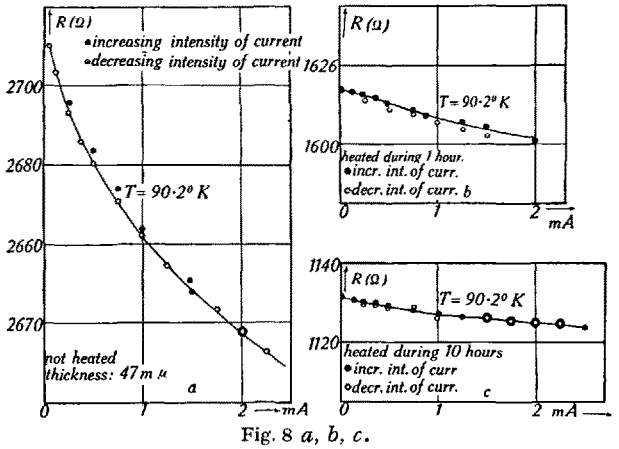

Fig. 8 *a*, *b*, *c*.

This is also confirmed by other experiments. For the not preheated films, the electrical resistance as a function of the current intensity deviates from Ohm's law (see Figs. 7*a* and 7*b*). But after the films have been heated up to about 150° C the curves change and finally agree with the classical equation.

As a general conclusion we are of the opinion that the electrical properties of these films depend strongly on the state of crystallization of the metal. It would therefore be interesting to follow the variation of the electrical properties and to determine simultaneously the electron diffraction patterns of the films.

Finally it is interesting to observe that the current density for these films is unexpectedly large. Thus for our films of 20 mμ and a breadth of 4 mm, and with a current of only 2 mA the current density is about 2500 A/cm².

A. VAN ITTERBEEK and L. DE GREVE[1]

Centre d'Etude scientifique et technique du froid, Louvain (Belgique), May 2, 1947.

Résumé

Dans une publication antérieure, nous avions signalé que le coefficient de température de la résistance électrique des films en nickel était négatif en dessous d'une certaine épaisseur critique (40 mμ). Au-dessus de 40 mμ, la courbe «Résistance en fonction de la température» présentait un minimum aux basses températures. A la suite de nouvelles expériences, nous avons constaté que ce phénomène est accompagné d'une déviation de la loi d'Ohm: la résistance diminue quand le courant de mesure augmente. Nous avons pu conclure que ces deux particularités ne sont qu'indirectement provoquées par la minceur des films. La cause principale est leur état de cristallisation imparfaite. En effet, après avoir subi un échauffement à 150° C pendant plusieurs heures, le coefficient de température négatif change de signe (le minimum disparaît) et la loi d'Ohm est respectée.

[1] Research-fellow of the Belgian «Fonds National de la Recherche Scientifique».

Über einheitliche Racemate des 1-Oxo-2-methyl-7-methoxy-octahydrophenanthren-2-carbonsäuremethylesters[1]

Die 1-Oxo-2-methyl-7-methoxy-octahydrophenanthren-2-carbonsäureester (I) stellen wichtige Ausgangsstoffe zum Aufbau des Östrons (II) dar. R. ROBINSON und J. WALKER[2] erhielten bereits 1936 den Äthyl- und 6 Jahre später W. E. BACHMANN und Mitarbeiter[3] den Methylester in Form von Ölen. Offenbar lagen Gemische der Racemate vor, von denen wegen der 3 Asymmetriezentren vier möglich sind. Östron besitzt 4 Asymmetriezentren, was 16 optischen Isomeren oder 8 Racematen entspricht. Wahrscheinlich beruhen die bisherigen Fehlschläge, zum natürlichen Östron zu gelangen, auf dem verwendeten, sterisch uneinheitlichen Ausgangsmaterial.

[1] 63. Mitteilung «Über Steroide» (62. Mitt., siehe Exper. *3*, 185 [1947]) sowie XIX. Arbeit «Über östrogene Carbonsäuren» (XVIII. siehe Helv. chim. Acta *30*, 786 [1947]).

[2] R. ROBINSON und J. WALKER, J. chem. Soc. London *747* (1936).

[3] W. E. BACHMANN und Mitarbeiter, J. Am. chem. Soc. *64*, 974 (1942).