Dr. E. VAN EVERDINGEN Jr. *On the increase of the resistance of bismuth in the magnetic field, in connection with the dissymmetry of the* HALL-*effect.*

In a communication to the Academy, presented in the Session of 18 April 1895, Dr. A. LEBRET [1]) has pointed out, that the dissymmetry of the HALL-effect in bismuth may be described mathematically by supposing the resistance of bismuth to increase unequally in the magnetic field for different directions. At the same time the possibility was pointed out of a connection between these directions and the principal crystallographic directions.

Also in my communications on thi subject, presented in the Session of 30 May 1896 [2]), this description is continually used, and the value of the difference in increase of resistance was calculated for some plates. Besides, the connection with the crystallographic directions was established almost beyond doubt. It was a matter of importance to decide whether the existence of this difference in resistance might be proved directly.

[1]) Communications N°. 19, p. 23.
[2]) Communications N°. 26.

For this purpose the following experiments were made

1. After determining the axes of symmetry in a round plate, a square was cut out of it with sides parallel to those axes. From the remaining borders two oblong pieces of bismuth were obtained; to each of them by means of WOOD's metal two „resistance-electrodes" were soldered on the same side-plane, which were connected through a resistance-box and one of the coils of a differential-galvanometer. Then the pieces were placed between the poles of the magnet so as wholly to cover each other, though they remained apart, and a current was sent through them traversing one after the other. In one of the resistance-boxes the resistance was left constant, say 100 Ohms, and in the other was determined for different magnetic fields the resistance necessary to annul the deflection observed at the differential-galvanometer on closing the primary current. In order to eliminate the error, caused by HALL-effect, the mean was taken of the values, obtained thus for both directions of the magnetic field.

Indicating by $a$ the ratio of the resistances when not in the field, that same ratio was found to be

1,005 $a$ in a magnetic field of 5500 c. g. s.
1,022 $a$ „ „ „ „ „ 7800 c. g. s.

2. In order to decide, whether the difference thus found between the resistances in different directions might be discovered also in the plates themselves, which served for the determination of the dissymmetry, „resistance-electrodes" were pressed against them along the directions of the axes, and the resistance was measured by means of the compensative-current. (See communication of 18 April 1895 [1])). Hence the primary current flows through the rheotan-wires (see that same communication) and the plate of bismuth in succession. The result was not satisfactory. The current in these plates flows by no means exclusively in the direction of the line joining the primary electrodes. Accordingly I had not expected to obtain in this manner the true ratio of the resistances. The unfavourable result however induced me to calculate the difference of potential between the primary electrodes, taking into account the difference in the increase of resistance in different directions, which calculation brought the result, that the difference of potential contains no term with the first power of the difference in resistance. So this method could afford no results and was abandoned accordingly.

3. One of the round plates used for other experiments was made out of a piece of bismuth, the crystalline structure of which looked homogeneous. From the remaining piece two little bars of bismuth were cut, with their greatest dimension parallel to the plane of the plate (which itself was parallel to a cleavage-plane of the crystalline piece of bismuth), in two perpendicular directions. These little bars were fastened in a frame of ebonite between two brass screws, which entirely covered the limiting planes whilst two thin resistance-electrodes were screwed on to one of the sides. The little bar was traversed by the primary current, and the resistance between the resistance-

[1]) Communications N°. 19, p. 5.

electrodes was compared as in § 2 with that of the rheotan-wires of the compensative-current It was found that in a magnetic field of $\pm$ 5700 c. g s, the resistance of N°. 1 had increased 5,4 perct., that of N°. 2 7,4 perct. The specific resistance of these bars was $\pm$ 154000 in c. g. s. units [1]; 2 perct. of this is $\pm$ 3100 c. g. s The dissymmetry of the HALL-effect ($K_{11}-K_{22}$ of LEBRET) observed in one of the positions of the plate was $\pm$ 2700 c. g. s. The directions of the edges of the bars with respect to the piece out of which they had been cut did not coincide wholly with those in which the axes of symmetry of the plate had pointed with respect to the same piece; moreover in round plates $K_{11}-K_{22}$ is proportional indeed but not wholly equal to the dissymmetry; the agreement between the above mentioned numbers is satisfactory, if the unevitable errors of observation are taken into account.

4. Also with this method of observation sometimes different values for the resistance before and after the reversing of the field were obtained The inquiry into the cause of this phenomenon is related in the next communication. From the experiments mentioned in § 1 and § 3 we may however conclude, that a different increase of resistance in the magnetic field really exists for different directions in crystalline bismuth.

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[1]) In this determination a rather large error may occur, as the distance between the electrodes was only 6 m.M.

Dr. E. VAN EVERDINGEN Jr. *On the relation between the crystallographic directions and the resistance, the magnetic increase of resistance and the* HALL-*effect in bismuth.*

1. The researches published in the preceding communication induced me to put to myself the question, in what manner the coefficient of magnetic increase of resistance in a fixed plane is related to the position of this plane and the direction of the magnetic force with respect to the crystallographic axis of bismuth. During closer inquiry also the question rose, in what manner the HALL-coefficient is related to the same direction. The answer to these questions is given in § 8. Let me describe the course of experiments in close connection with the former communication.

2. The increase of resistance in the magnetic field being determined for the little bars, mentioned in the latter part of the former communication, the same experiments were repeated with a bar, cut from the same crystalline piece in a direction $\perp$ the former two and $\perp$ the principal cleavage-plane. It appeared, not only that this bar had a greater specific resistance, but also that it showed a much greater magnetic increase of resistance. Whereas for instance with N°. 2 a resistance was found of 154000 c. g. s. when not in the field, and a magnetic increase of resistance of 7,4