

Citation:

Martin, P., The magneto-optic Kerr-effect in ferromagnetic compounds IV, in:
KNAW, Proceedings, 16 I, 1913, Amsterdam, 1913, pp. 318-331

This observation of STERNS seems not to be applicable in a comparison of small and large adults.

Resuming my results, I may state the following conclusions:

1st. In the spinal cord of large individuals of the same order the relation of the white substance to the grey is much more in favour of the white than in small individuals.

2nd. This rule holds good for all the classes and orders examined.

3^d. This phenomenon can be explained — and according to my opinion has to be explained — by the explication given by ERNST DE VRIES (vide supra).

4th. Also the shape of the grey matter shows a modification in large animals in so far as it becomes more gracile, which is chiefly demonstrated by the distance of and the grey connection between the horns.

Physics. — “*The magneto-optic KERR-effect in ferromagnetic compounds.*” IV. By PIERRE MARTIN of Geneva. (Communication from the BOSSCHA-Laboratory by Prof. H. DU BOIS.)

In a former paper¹⁾ I have given the dispersion curves of the KERR-effect for certain manganese and iron compounds. It should be particularly noticed that almost all of these curves, as has been further confirmed with new material, show an algebraic maximum and minimum between or near the limits of the visible spectrum. In the present research I have determined some new dispersion-curves and have also investigated in the case of a few substances the relation between the KERR-effect and the temperature.

For this purpose the material was cut into small discs of the same size as the pole-top (V, 7 mm.) face, and this entire system completely insulated from the pole-shoes by a layer of asbestos. The heating was accomplished by means of an ordinary Bunsen burner. Up to 300° the temperature was measured with a thermometer imbedded close to the mirror. For higher temperatures up to 450° a compressed nitrogen thermometer was used.

By regulating the flame the temperature could be kept constant to within about 5°. In order to prevent as much as possible oxydation and “tarnish colours” the mirror was constantly bathed with carbon dioxide which had been led over KMnO_4 , SnCl_2 ,

¹⁾ P. MARTIN. These Proceedings 15, p. 138, 1912.

NaHCO_3 and CaCl_2 ¹⁾. A few measurements were made at a low temperature, the whole system being imbedded in carbon dioxide snow.

Otherwise the experimental arrangement was the same as hitherto ²⁾ except that instead of the small half-ring a large du Bois full-ring electromagnet was used. With this all of the mirrors investigated were capable of saturation, since the strongest field was estimated at from 30 to 40 kilogauss.

The direct-vision high-luminosity monochromator ³⁾ was recalibrated at several points with the aid of a mercury vapour lamp. The observations proper were made exclusively with an arc lamp. The field was reversed each time to eliminate constant errors and the observed values corrected for the FARADAY-rotation in the air-path. In view of the smallness of the rotations it proved still impossible to determine the ellipticity.

As regards the material, it was found that most pulverized substances by moderate compression with or without binding material could also be worked up into pastils which were more or less capable of polish.

The present research aims principally at a general knowledge with regard to the magneto-optical properties. Especially is this true of the temperature curves the range and precision of which need still to be extended considerably.

In the following tables I denote as hitherto by: λ , the wave length of the light in question in $\mu\mu$; Δ , the double rotation on reversing the current as read off the scale in mm.; $\pm d\epsilon$, the mean error respectively in minutes or in percent. N is the number of readings made for each direction of the current, which varied according to the brightness of the mirror from 10 to 30; t , the temperature; θ_0 , the temperature at which the magnetizability vanishes.

To Geh. Rat. G. TAMMANN, Göttingen, Prof. P. WEISS, Zürich, Privatdocent Dr. S. HILPERT, Charlottenburg, and to the firm, Griesheim-Elektron, I am greatly indebted for kindly supplying valuable materials.

BINARY MANGANESE COMPOUNDS.

Manganese Arsenide (Mn As, HILPERT, $\theta_0 = 45^\circ$). The rotation in

¹⁾ R. SIEDENTOPF Dissert p 8 Göttingen 1897.

²⁾ Cf. ST. LORIA. These Proceedings **12** p. 835, 1910; **14**, p. 970, 1912.

³⁾ H. du Bois, Ztschr. für Instr. Kunde **31**, p. 1. 1911.

the yellow amounted to about 1.5' and appeared to vanish in the orange.

Manganese Antimonide (Mn. 35. Sb. 65 = MnSb nearly, TAMMANN, $\theta_0 = 265^\circ$). The dispersion curve is given in my first paper (l.c. Fig. 2). The temperature curve, $\varepsilon = \varphi(t)$, is represented in table 1. Below 60° the rotation remains constant. In the neighbourhood of 80° it begins to decrease and thereafter continues to decrease at a nearly linear rate. The zero point seems to lie at about 265° . After heating to 205° the rotation rose again to its former value on cooling and, therefore, does not show thermal hysteresis. A second heating gave the two last points near 222° and 245° . Further heating destroyed the mirror.

TABLE 1.

$\varepsilon = \varphi(t)$ Mn Sb (saturated) $\lambda = 567 \mu\mu$

N	t	Δ (mm)	ε (min.)	$\pm \delta\varepsilon$ (min.)	%
15	25°	— 124.6	— 17.4	0.05	0.3
15	$50--60^\circ$	— 125.0	— 17.5	0.05	0.3
15	$97--103^\circ$	— 113.5	— 15.9	0.1	0.6
10	$145--155^\circ$	— 71.4	— 11.0	0.2	2.0
10	$185--193^\circ$	— 49.3	— 6.9	0.2	3.0
15	$200--205^\circ$	— 40.7	— 5.7	0.05	1.0
12	$215--220^\circ$	— 27.8	— 3.9	0.1	2.5
15	$240--245^\circ$	— 14.3	— 2.0	0.1	5.0

BINARY IRON COMPOUNDS.

Iron Carbide I, (Cementite HILPERT, $\theta_0 = 235^\circ$). WOŁOGDIN found for the transition temperature 180° , which with the apparatus used by him may represent a lower limit. MAURAIN observed in the case of high degree carbon steels irregularities below 240° . This was confirmed by SMITH, WHITE, BARKER and GUILD who ultimately extracted the cementite powder from their steel by the ARNOLD process¹⁾. The

¹⁾ M. WOŁOGDIN, Compt. Rend. 148, p. 776, 1909; CH. MAURAIN, Compt. Rend. 150, p. 779, 1910; Ann. d. Chim. et Phys. (8) 20, p. 372, 1910; S. W. F. SMITH, W. WHITE, S. G. BARKER und G. GUILD, Proc. Phys. Soc. London 24, pp. 62, 342, 1912 und 25, p. 77, 1912; I. O. ARNOLD, Journ. Iron & Steel Inst. 1, p. 174, 1910.

final drop in the magnetization was found by them to lie between 200° and 240° for fields of about 10 gauss. First of all was available the sample I, which had been etched with H_2SO_4 . Fig. 1 represents the temperature curve between -78° and $+220^\circ$. The curve extended cuts the axis of abscissae near 235° in agreement with the results of the other observers just cited.

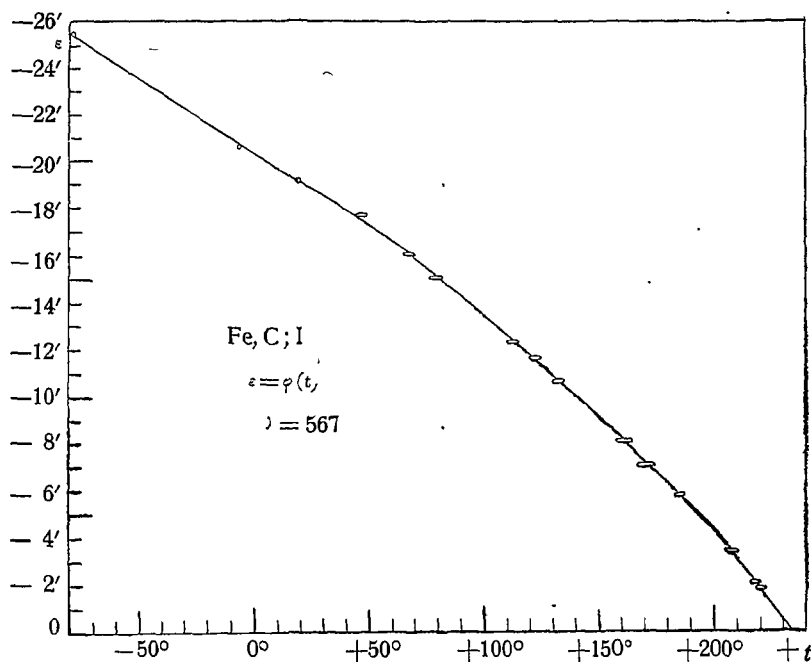


Fig. 1.

I received from Dr. HILPERT, also, two different pulverized cements which after pressing in the dry state could be polished fairly well. These, it should be noticed, gave entirely distinct dispersion curves, different from those for sample I, which moreover differed among themselves. While the latter shows a maximum and minimum of the rotation respectively in the violet-blue and in the green-yellow, these singularities are displaced in the case of samples II and III. All, however, gave strong negative rotations which will now be discussed more in detail.

Iron Carbide II (4.8% C, about 20% free iron, HILPERT) shows a powerful rotation (between $-18'$ and $-21'$) with a numerical maximum in the yellow and a minimum in the orange-red. (Fig. 2). The mirror, which had a distinct yellowish appearance, scarcely

reflected the blue light at all, so that it was impossible to use wavelengths shorter than $483 \mu\mu$.

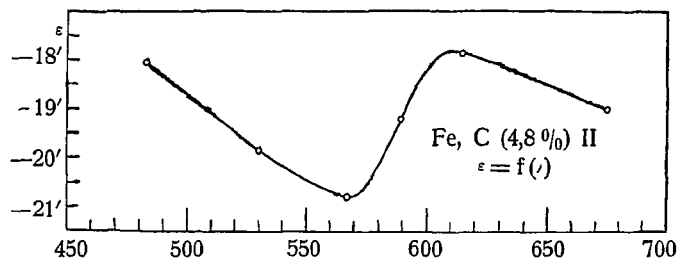


Fig. 2.

On heating, the surface near 80° lost its reflecting power. After repolishing this occurred again, so that no temperature curve could be determined.

Iron carbide III (15% C, HILPERT, $\theta = 183^\circ$). Here the rotation was smaller (between $-4'$ and $-14'$) and showed a numerical minimum in the blue-green. Yellowishness of the mirror, however, prevented measurements in the blue below $466 \mu\mu$.

The dispersion curve is shown in Fig. 3.

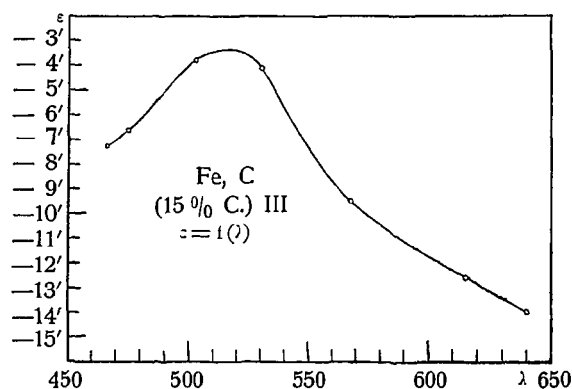


Fig. 3.

Above 110° the rotation decreased gradually and at a nearly linear rate up to about 183° . The reflected image finally became indistinct and during the cooling only a small rotation of $1.5'$ could with difficulty be perceived. This observation was repeated. Gentle polishing, however, served to restore the original condition completely, so that the phenomenon cannot be regarded as thermal hysteresis.

The temperature curve is shown in Fig. 4.

The zero point agrees with that found by WOŁODIN. According

to HILPERT the sample III contains free carbon together with a new higher carbide, possibly FeC_2 or FeC . The diversity of the

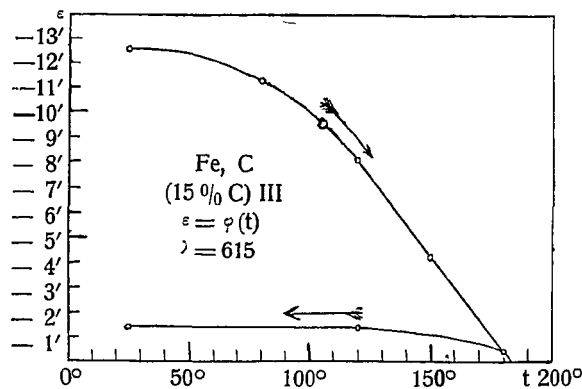


Fig. 4.

results may, therefore, be due to the presence of two or even three carbides or mixtures of the same, which is interesting from a metallurgical point of view.

Ferrosilicon (atomic percentage of Si 30, TAMMANN, $\theta_0 > 450^\circ$) Conglomerate of mixed crystals. The saturated mixed crystal with 33,3 atom. perc. Si has the same composition as the compound, Fe_2Si whose existence is still uncertain¹⁾. The hard material could be finely polished. The substance is characterized by a powerful negative rotation increasing continuously from the violet to the red and by the absence of singularities in the dispersion curve. (Tab. 2).

T A B L E 2.
 $\varepsilon = f(\lambda)$ Ferrosilicon (saturated) TAMMANN.

N	$\lambda(\mu\mu)$	Δ (mm)	ε (min.)	$\pm \sigma\varepsilon$ (min.)	%
20	435	— 93.9	— 13.18	0.04	0.3
20	450	— 101.3	— 14.22	0.04	0.3
18	483	— 111.1	— 15.58	0.03	0.2
20	530	— 119.5	— 16.75	0.02	0.15
25	567	— 123.2	— 17.27	0.01	0.06
30	615	— 126.0	— 17.65	0.01	0.06
20	675	— 128.0	— 17.91	0.02	0.1
17	703	— 129.1	— 18.05	0.03	0.2

¹⁾ G. TAMMANN und W. GUERTLER, Zeitschr. f. Anorg. chem. 47, p. 163, 1905.

The rotation, already somewhat smaller at 80° , decreases slowly and at a nearly linear rate up to 280° after which it falls off very rapidly and vanishes apparently at about 460° . The course of the observations was as follows. The mirror was heated gradually up to 300° . At 340° it began to tarnish. The freshly polished mirror was then heated as rapidly as possible, since the "tarnish colours" form only slowly, up to 305° . Here a few test readings were taken which were satisfactorily continuous with the previous ones. At 400° , however, the mirror began to discolour again, the rotation increasing gradually. Nevertheless, I was able to estimate the minimum value of the rotation at about 4° . The behaviour on cooling could not be determined on account of the tarnish. The temperature curve is given by Table 3.

TABLE 3.
 $\varepsilon = \varphi(t) \quad \lambda = 615 \mu\mu \quad \text{Ferrosilicon (saturated)} \quad \text{TAMMANN.}$

N	t	Δ (mm.)	ε (min.)	$\pm \delta\varepsilon$ (min.)	%
30	25°	— 126.0	— 17.65	0.01	0.06
15	87°	— 121.1	— 16.96	0.02	0.1
14	120°	— 115.3	— 16.16	0.02	0.1
15	160°	— 107.5	— 15.05	0.03	0.2
17	202°	— 101.0	— 14.15	0.04	0.3
15	243°	— 92.8	— 12.99	0.04	0.3
20	295°	— 82.7	— 11.56	0.02	0.2
10	305°	— 75.4	— 10.6	0.1	1
	405°	— 28	— 4		

Ferrocobalt; (Fe_2Co , WEISS and VON FREUDENREICH, $\theta_0 = 987^\circ$). This substance was investigated by PREUSS¹⁾; its intensity of magnetization at saturation, as is well known, is about 10% greater than that for pure iron. It shows, accordingly, throughout the entire spectrum the most powerful rotation yet observed and a clearly distinguishable ellipticity. The curve has a sharp minimum in the violet, then rises rapidly in the green and less rapidly in the red where the maximum rotation amounts to about — 34° .

¹⁾ A. PREUSS, Dissert Techn. Hochschule. Zürich 1912.

T A B L E 4.
 $\varepsilon = f(\lambda)$ Fe_2Co (saturated) WEISS.

N	$\lambda (\mu\mu)$	Δ (mm)	ε (min.)	$\pm \delta\varepsilon$ (min.)	%
30	435	— 156.3	— 22.11	0.04	0.2
25	458	— 153.2	— 21.67	0.04	0.2
30	475	— 155.6	— 22.00	0.03	0.25
10	503	— 170.0	— 24.05	0.04	0.15
25	530	— 189.8	— 26.85	0.02	0.08
20	567	— 211.7	— 29.94	0.01	0.03
25	615	— 223.9	— 31.69	0.02	0.06
20	675	— 235.6	— 33.33	0.04	0.12
25	695	— 239.6	— 33.89	0.05	0.15

Ferronickel (Fe_2Ni , WEISS and VON FREUDENREICH¹⁾). The dispersion curve belongs to the general type showing a numerical maximum in the yellow and a minimum in the red. (Tab. 5). The rotation is, however, greater and the form of the curve different than for the nickel iron alloys (25.4, 27 and 36 percent nickel) investigated by LORIA²⁾. As regards the effect of temperature, the rotation increases on heating from -78° at first slowly and then more rapidly (Tab. 6). Owing to the "tarnish colours" it was impossible to make measurements above 250° at which point the rotation had decreased to about one half its initial value.

META-FERRITE SERIES.

In these compounds, whose composition has been determined by HILPERT³⁾ and which are related structurally to ferroferrite, the iron oxyde acts as the acid radical and as the seat of the ferromagnetic properties. Available were calcium-, ferro-, ferr-, cobalto-, cupri-, and zincferrite, all of which are more or less magneto-optically active. They are arranged in the following in the order of the atomic weight of the basic component.

¹⁾ Cf. F. HEGG, Diss. Techn. Hochschule Zürich 1910.

²⁾ ST. LORIA, l. c. As a matter of fact the compound, Fe_2Ni , behaves differently and forms an exception to the general nickel steel series; cf. S. HILPERT and E. COLVER-GLAUERT, Zeitschr. f. Electrochemie **17**, p. 760, 1911.

³⁾ S. HILPERT Verh. D. Phys. Ges. **11**, p. 293, 1909. Ber. D. Chem. Ges. **42**, p. 2248, 1909.

TABLE 5.

 $\varepsilon = f(\lambda)$ Fe₂Ni (saturated) WEISS

N	$\lambda(\mu\mu)$	Δ (mm)	ε (min)	$\pm \delta\varepsilon$ (min.)	θ_0
20	435	— 125.3	— 17.56	0.05	0.25
15	483	— 141.9	— 19.88	0.05	0.25
20	530	— 154.8	— 21.69	0.03	0.15
18	567	— 160.9	— 22.55	0.03	0.14
13	589	— 159.1	— 22.29	0.03	0.14
18	615	— 145.2	— 20.30	0.03	0.15
20	640	— 133.0	— 18.61	0.02	0.11
20	675	— 138.1	— 19.33	0.03	0.15
20	703	— 142.9	— 20.00	0.05	0.25

TABLE 6.

 $\varepsilon = \varphi(t)$ $\lambda = 567 \mu\mu$ Fe₂Ni (saturated) WEISS

N	t	Δ (mm)	ε (min)	$\pm \delta\varepsilon$ (min.)	θ_0
30	— 78°	— 131.7	— 18.46	0.02	0.1
20	+ 20	— 126.4	— 17.70	0.02	0.1
12	+ 88—93°	— 112.0	— 15.68	0.04	0.25
15	+ 117—122	— 106.5	— 14.91	0.03	0.2
15	+ 158—163	— 96.0	— 13.44	0.04	0.3
17	+ 200—205	— 86.3	— 12.08	0.03	0.25
15	+ 240—245	— 74.8	— 10.47	0.03	0.3

Calcium ferrite. (CaO . Fe₂O₃, HILPERT, $\theta_0 = 156^\circ$). The rather hard brittle material could be nicely polished. The failure of LORIA to obtain an effect with this same substance was probably due to an accidental selection of those points in the spectrum at which the rotation is either zero or very small. It is exceedingly minute, to be sure, throughout. Nevertheless, I was able to determine a curve. This is of the general type with an algebraic minimum in the blue,

maximum in the green and zero points near $510 \mu\mu$ and $590 \mu\mu$. (Fig. 5 \times points).

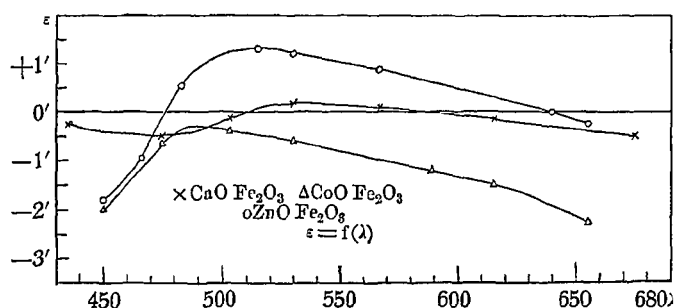


Fig. 5

The rotation was too small for the determination of a temperature curve.

Titanium ferrite ($\text{Ti}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$, Ilmenite, regular). The same mirror as used by LORIA without result gave no measurable effect ($\epsilon < 0,1'$).

Ferroferrite ($\text{FeO} \cdot \text{Fe}_2\text{O}_3$, magnetite electrode of the firm Griesheim-Elektron, $\theta_0 > 500^\circ$). The dispersion curve is very similar to those found by LORIA for a natural octahedral surface and by WEISS for calcined amorphous Fe_3O_4 . The maximum \pm rotations are, however, somewhat less. The singular points of the three curves are located as follows:

Ferroferrite	Zero-point	Maximum
Natural Octahedral Surface	$464 \mu\mu$	ca. $575 \mu\mu$
Calcined Amorphous	$492 \mu\mu$	$615 \mu\mu$
Magnetite Electrode	$496 \mu\mu$	$600 \mu\mu$

The position of the flat maximum is, of course, more or less uncertain. The agreement is, therefore, much better than e.g. with the cementite samples.

On heating the decrease in the rotation begins before 200° and continues nearly linearly up to 430° . A straight line extrapolation of the curve cuts the axis of abscissae near 510° (Tab. 8). On cooling the point near 200° was again observed and at ordinary temperature the values of the rotation agreed with those before heating.

Ferriferrite [$\text{Fe}_2\text{O}_3 \cdot 2\text{Fe}_2\text{O}_3$, martite, pseudomorphous with octahedral magnetite, from Twin Peaks, Utah]. The above form of the

TABLE 7.

 $\varepsilon = f(\lambda)$ Magnetite Electrode (saturated) GRIESHEIM.

N	$\lambda (\mu\mu)$	$\Delta (\text{mm})$	$\varepsilon (\text{min.})$	$\pm d\varepsilon (\text{min.})$	$\%$
20	435	- 20.6	- 2.91	0.12	4
20	450	- 17.9	- 2.53	0.10	4
20	466	- 15.4	- 2.17	0.05	2.5
15	483	- 7.7	- 1.10	0.06	5.5
20	493	- 3.0	- 0.43	0.02	4.5
15	503	+ 5.1	+ 0.70	0.04	6
10	530	+ 19.3	+ 2.69	0.08	3
25	567	+ 30.6	+ 4.27	0.01	0.2
12	589	+ 32.4	+ 4.54	0.05	1
15	615	+ 31.8	+ 4.44	0.03	0.7
30	675	+ 25.2	+ 3.53	0.02	0.6
15	695	+ 22.4	+ 3.14	0.10	3
20	712	+ 19.7	+ 2.76	0.15	5.5

TABLE 8.

 $\varepsilon = \varphi(t)$ $\lambda = 589 \mu\mu$ Magnetite Electrode (saturated) GRIESHEIM.

N	t	$\Delta (\text{mm})$	$\varepsilon (\text{min.})$	$\pm d\varepsilon (\text{min.})$	$\%$
12	20°	+ 32.4	+ 4.54	0.05	1
17	135-140°	+ 31.5	+ 4.40	0.03	0.7
15	200-205°	+ 27.9	+ 3.91	0.05	1.3
20	305-310°	+ 18.0	+ 2.52	0.04	1.6
15	425-430°	+ 7.3	+ 1.02	0.05	5

chemical symbol is in accordance with the theory of HILPERT which supposes that in the case of magnetic iron oxide the basic and acid properties are united in one and the same molecule. It is, however, conceivable that the very slight activity of the acid radical may be due to an admixture of foreign basic oxide in the mineral.

In any case, I was able using a polished surface to measure with tolerable precision an exceedingly minute rotation. ($\varepsilon < 0,2'$). This increases somewhat toward the blue and seems to weaken at the end toward the red. The form of the curve is, of course, very uncertain. (Tab. 9).

TABLE 9.

$\varepsilon = f(\lambda)$ Martite (saturated) TWIN PEAKS

N	$\lambda(\mu\mu)$	Δ (mm)	ε (min.)	$\pm \delta\varepsilon$ (min.)	%
25	466	+ 3.4	+ 0.45	0.05	11
20	503	+ 1.7	+ 0.22	0.04	18
15	530	+ 0.8	+ 0.10	0.03	33
25	567	+ 1.3	+ 0.18	0.03	11
18	615	+ 0.6	+ 0.08	0.03	37
15	640	0.0	- 0.01	0.04	
30	640	+ 0.6	+ 0.08	0.03	37

The smallness of the rotation did not permit a determination of the temperature curve.

Ferriferite ($Fe_2 O_3 \cdot 2Fe_2 O_3$, haematite, hexagonal, from Elba, $\theta_0 = 645^\circ$). The same as above holds for the natural specular ore¹⁾. From an excellent crystal a mirror was cut parallel to the principal axis. LORIA was able for this direction to give only an upper limit for the rotation, 0,2. In view of the positive results with martite it seemed that the rotation with haematite could perhaps also be measured. This proved to be the case, the rotations lying in the neighbourhood of the above limiting value and being likewise positive. The increase toward the violet appears to be less marked than with martite, but little weight can be attached to the exact form of the curve. (Table 10).

A beautifully reflecting mirror cut parallel to the base gave, in agreement with LORIA's result, absolutely no rotation. The base is, therefore, a "ferromagnetic plane". It was out of the question to determine the temperature curve.

¹⁾ T. KUNZ. (Neues Jahrb. f. Mineral. etc. p. 86 1907) determined for simple normal haematite $\theta_0 = 645^\circ$; the optical constants were measured by G. FÖRSTERLING, loc. cit. Beil. 25, p. 344, 1907.

TABLE 10.

 $\varepsilon = f(\lambda)$ Haematite (saturated) ELBA

N	$\lambda(\mu\mu)$	Δ (mm)	ε (min.)	$\pm \delta\varepsilon$ (min.)	%
20	450	+ 2.1	+ 0.27	0.1	37
20	483	+ 0.8	+ 0.10	0.05	50
18	530	+ 1.0	+ 0.14	0.02	14
20	580	+ 0.7	+ 0.09	0.01	11
25	615	+ 0.1	+ 0.01	0.02	
30	648	+ 0.9	+ 0.13	0.03	23

Cobaltoferrite ($\text{CoO} \cdot \text{Fe}_2\text{O}_3$, HILPERT, $\theta_0 = 520^\circ$). The material, a black powder, yielded a sufficiently reflecting mirror. The rotation is throughout the entire spectrum negative and reaches a numerical minimum in the blue green. (Fig. 5). Up to 250° I was unable to detect any decrease in the rotation.

Cupriferrite ($\text{CuO} \cdot \text{Fe}_2\text{O}_3$, HILPERT, $\theta_0 = 420^\circ$). LORIA has determined the dispersion curve (l.c. p. 897). On heating, the rotation remains constant up to 200° . It then decreased at first slowly and then somewhat more rapidly up to 420° where it vanished. On cooling, the rotation regained its original value. (Table 11).

TABLE 11.

 $\varepsilon = \varphi(t)$ $\lambda = 475 \mu\mu$ Cupriferrite (saturated) HILPERT

N	t	Δ (mm)	ε (min.)	$\pm \delta\varepsilon$ (min.)	%
15	25°	+ 12.8	+ 1.75	0.03	2
20	$212-217^\circ$	+ 12.5	+ 1.71	0.02	1
15	$280-287^\circ$	+ 11.5	+ 1.51	0.03	2
15	$347-353^\circ$	+ 6.7	+ 0.91	0.04	4
15	$385-393^\circ$	+ 3.4	+ 0.50	0.04	8
20	$410-415^\circ$	+ 1.0	+ 0.16	0.03	19

Zincferrite. ($\text{ZnO} \cdot \text{Fe}_2\text{O}_3$, Franklinite, from Franklin, New Jersey, $\theta_0 = 62^\circ$). The sign of the rotation changes twice within the

spectrum. It is positive in the green and negative at the two ends. The zero points are near $477 \mu\mu$ and $640 \mu\mu$. The form of the curve, also, indicates a minimum in the ultra-violet. (Fig. 5, \circ points).

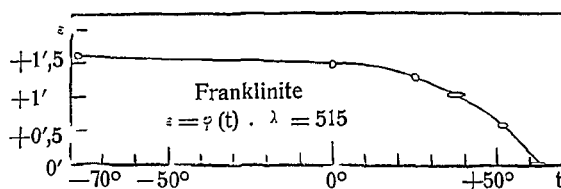


Fig. 6.

The rotation decreases very slowly from -78° to 0° . It then falls off rapidly, vanishing between 60° and 65° . (Fig. 6). In agreement with this WOLOGDIN found 61° for the transition temperature.

Physiology. — “*On the TYNDALL-phenomenon in gelatin-solutions.*”

By L. ARISZ. (Communicated by Prof. H. ZWAARDEMAKER).

(Communicated in the meeting of June 28, 1913).

In watching the TYNDALL-phenomenon in a 1% gelatin-solution Prof. ZWAARDEMAKER observed a greater intensity of the diffused light after the change from sol to gel than before the gelatification.

This prompted me to investigate the TYNDALL-phenomenon more closely.

For a determination of the intensity of the light a method was adopted that has been suggested by HARTMANN¹⁾. My mode of procedure was the following: A series of photographs were taken of the TYNDALL-phenomenon at right angles to the incident pencil and the intensity was calculated every time from the grade of blackness of the picture. This estimation was based on the principle, that when a number of plates, as uniform as possible, are exposed under precisely the same conditions of time, temperature, development and further treatment, the density of the negative will depend only on the intensity of the light.

Different portions of a plate being successively exposed at various known distances to the same constant light-source for an equal space of time, afford a suitable scale of various grades of blackness. For

¹⁾ Zs. f. Instrum. 19. 97. 1899.