



Susceptibility and Verdet's constant of liquids

H.E.J.G. Du Bois

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stratification &c. is preserved. A few grains of peridot now begin to make their appearance, chiefly as inclusions within the calcite crystals, and thus by degrees the results already recorded are effected. In the early stages only is the metamorphism selective. The order in which the new minerals seem to develop is the following:—

- (1) Peridot, Periclase, Humite.
- (2) Spinel, Mica, Fluorite, Galena, Pyrites, Wollastonite.
- (3) Garnet, Idocrase, Nepheline, Sodalite, Felspar.

Many of these minerals are crowded with microliths, which there is reason to believe consist of pyroxene.

XXXV. *Intelligence and Miscellaneous Articles.*

SUSCEPTIBILITY AND VERDET'S CONSTANT OF LIQUIDS.

BY H. E. J. G. DU BOIS.

THIS investigation, carried out in the physical institute of Strasbourg University, had for its principal object to decide whether the two "constants" above mentioned are really constant within a considerable range of magnetizing forces; Silow, Schuhmeister, and Quincke, on the one hand, Stscheglaieff, on the other, having found variations of the susceptibility and of Verdet's constant respectively.

The magnetic measurements were made by Quincke's second manometric method*; an apparatus being specially constructed in order to exactly set the manometer's narrow tube to any given angle with the horizon. When this angle is made very small, say 30', quantitative measurement becomes somewhat difficult; but the method then affords an excellent qualitative test. When the difference in susceptibility of the liquid and the adjoining gas is but one ten-thousandth of the susceptibility of water, it may still be detected by this method, first used by Quet and Verdet, and quite recently developed by Toepler and Hennig. The space above the liquid was not generally evacuated, but filled with coal-gas or carbonic acid, whose susceptibility may be neglected. By substituting oxygen for the gas, always keeping the same liquid, the susceptibility of the former may be measured in terms of that of the liquid.

The field between the poles of the large electromagnet used was measured by means of Leduc's magnetometer†, based on Lippmann's mercurial galvanometer.

A Lippich's polarizer was used to determine the rotation of the plane of polarization.

The following is a summary of the results obtained:—

The susceptibility and Verdet's constant for all simple liquids, salts in solution, and gases, appear to be constant for magnetizing

* Quincke, *Wied. Ann.* vol. xxiv. p. 374 (1885).

† Leduc, *Journ. de Phys.* [2] vol. vi. p. 184 (1887)

forces up to 12,500 C.G.S. (and probably up to much higher values). This was proved by direct measurement on H_2O , and solutions of $FeCl_3$ and $MnCl_2$ within the range of experimental errors.

A solution of any paramagnetic salt in a diamagnetic liquid may be brought to a certain concentration at which it is magnetically "inactive" in a given field. By the qualitative test alluded to it was then found inactive in any other field; from this fact an indirect verification of the absolute constancy of the susceptibility of both the liquid and the salt in solution is easily deduced. Various salts and oxygen were thus tried, all with the same result.

The properties of solutions were further investigated at some length, specially at the concentrations for which they proved either optically or magnetically inactive; the general result being a confirmation of the assumption usually made, viz. that the action of solvent and dissolved salt is algebraically superposed.

So-called amalgam of iron seems to behave differently from simple liquids; its magnetization appears to reach a maximum like that of massive iron. This result was calculated from some of Quincke's data by a formula deduced on the most general assumption of varying susceptibility. The reason of this probably is that the amalgam is neither a chemical compound nor a real solution, but rather an emulsion of exceedingly small particles of iron in the mercury. However, this question can hardly be decided without further experiment.

The susceptibility of oxygen (at 1 atmosphere of pressure) relatively to that of water was found to be 0.14 at 15° . It was found to decrease with temperature much more rapidly than the density, a result published somewhat earlier by Quincke*.

The temperature-coefficient of the susceptibility of water was found to be a decrease of 0.25 per cent. per degree.

Besides the qualitative verification of the sign of the susceptibility and of Verdet's constant for the substances most characteristic in this respect, absolute determinations were made of the susceptibilities of a few standard substances. The values at temperature 15° are contained in the following table, the susceptibility of a vacuum being of course taken as zero (its permeability = 1).

Substance.	Density.	Susceptibility.
Water.....	0.9992	$-0.837 \cdot 10^{-6}$
Alcohol	0.7963	-0.694 „
Ether	0.7250	-0.642 „
Bisulphide of carbon	1.2692	-0.816 „
Oxygen; 1 atmosphere ...	0.00135	$+0.117$ „
Air; 1 atmosphere	0.00123	$+0.024$ „

* Wied. *Ann.* vol. xxxiv. p. 442 (1888).

For the details of experiment, for the discussion of its results and of those previously obtained, the original must be referred to. — Wiedemann's *Annalen*, vol. xxxv. p. 137 (1888).

SELECTIVE ABSORPTION OF METALS FOR ULTRA-VIOLET LIGHT.

BY JOHN TROWBRIDGE AND W. C. SABINE*.

The question of the absorption of the ultra-violet rays by metallic surfaces possesses considerable interest, both from a practical and a theoretical point of view. By the kindness of Prof. Pickering, Director of the Harvard University Observatory, we were provided with a number of metallic surfaces prepared by Professor Wright of Yale College. These metallic surfaces were deposited upon glass by means of electricity. The surfaces were of gold, platinum, tellurium, palladium, copper, silver, and steel. A preliminary trial had shown us that a heliostat mirror of the same composition as that upon which the grating was ruled did not absorb light of greater wave-length than 2900. We resolved, therefore, to compare other metals with speculum metal. Since our heliostat arrangement required two mirrors to direct the light upon the slit of the spectroscope, we employed a speculum mirror for the movable mirror of the heliostat, and replaced the fixed mirror by mirrors of metals whose selective absorption we wished to compare with that of speculum metal. To our surprise, the metallic mirrors of gold, copper, nickel, steel, silver, tellurium, and palladium all reached the same limit as speculum metal. Here was a complete experimental proof that colour in no way influences the selective absorption of metals for the ultra-violet rays; for the copper mirror, which gave a strong yellow light by reflexion, was as capable of reflecting light of as short wave-length as the brilliant white surface of polished silver. Although the metallic surfaces we employed were bright, slight differences in polish undoubtedly existed, and therefore we are not justified in placing much reliance upon the evidence presented by the intensity of the photographs of the solar spectrum obtained by light reflected into the spectroscope by these various metallic surfaces. The photographs, however, can be classified according to intensity, in order of numbers as follows, number 1 indicating the greatest intensity:—1, steel; 2, gold; 3, platinum; 4, palladium; 5, silver; 6, tellurium; 7, copper.

It was evident from these experiments that selective absorption of metals is far less than the absorption exercised by the earth's atmosphere. We therefore resolved to employ the light of the electric spark between metallic terminals, in order to ascertain whether any limit of absorption could be reached. For this purpose, the light of the spark between copper terminals was reflected, by means of a mirror of the metal whose selective absorption we wished to examine, upon the slit of the spectroscope. To protect the

* From an advance proof from the 'Proceedings of the American Academy.' Communicated by the Authors.