British Association for the Advancement of Science

REPORT OF THE COMMITTEE

APPOINTED FOR THE PURPOSE OF CONSIDERING THE SUBJECT OF

ELECTROLYSIS

IN ITS PHYSICAL AND CHEMICAL BEARINGS

From the British Association's Report, 1886

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Report of the Committee, consisting of Professors ARMSTRONG *and* LODGE (*Secretaries*), Sir WILLIAM THOMSON, Lord RAYLEIGH, Professors SCHUSTER, POYNTING, J. J. THOMSON, FITZGERALD, CRUM BROWN, RAMSAY, FRANKLAND, TILDEN, HARTLEY, MCLEOD, CAREY FOSTER, ROBERTS-AUSTEN, RÜCKER, REINOLD, *and* S. P. THOMPSON, Captain ABNEY, Drs. GLADSTONE, HOPKINSON, *and* FLEMING, *and* Messrs. W. N. SHAW, H. B. DIXON, J. T. BOTTOMLEY, W. CROOKES, SHELFORD BIDWELL, *and* J. LARMOR, *appointed for the purpose of considering the subject of Electrolysis in its Physical and Chemical bearings.—Edited by* OLIVER LODGE.

THE members of the Committee have communicated with each other by correspondence, and have individually undertaken the investigation of various points more or less closely bearing on the subject, some of which were specified by the present editor at the conclusion of a paper on Electrolysis, printed in the annual volume for last year. (See page 765.)

The sum of 20*l.* granted to the Committee has been expended, partly in providing chemicals and simple appliances for experiments, and partly in printing and circulating various interim communications, to wit, letters among the members and letters received from foreign philosophers.

The work of the Committee is greatly facilitated by being thus able freely to communicate on matters of interest; and, inasmuch as it is thought desirable to continue this practice, and also to experiment on material of special purity, a somewhat larger grant is asked for this year. Some of the work undertaken by the members is only recently begun, and not yet reported on, but that concerning which an account has been communicated to the Committee is here appended, together with a few abstracts and translations of foreign memoirs, which it seemed desirable to bring together in an accessible form.

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Sir William Thomson communicates to the Committee Mr. Thomas Gray's paper 'On the Electrolysis of Silver and of Copper, and the application of Electrolysis to the Standardising of Electric Current and Potential Meters,' as published in the 'Philosophical Magazine' for November 1886; and remarks that it treats of questions referred to in the rest of the Report, especially to those raised by Mr. Shaw in Table IV. on p. 325.

Professor Armstrong's paper 'On Electrolytic Conduction in relation to Molecular Composition, Valency, and the Nature of Chemical Change: being an attempt to apply a theory of "Residual Affinity,"' is published in the 'Proceedings of the Royal Society,' No. 243, 1886.

Professor McLeod's paper 'On the Electrolysis of Aqueous Solutions of Sulphuric Acid, with special reference to the forms of oxygen obtained,' is to be found in the 'Journal of the Chemical Society' for August 1886, vol. xlix.

Professor J. J. Thomson and Mr. Newall have been working at Cambridge on conduction through very bad conductors, such as olive oil, bisulphide of carbon, paraffin oil, &c. They find that for electromotive forces up to 100 volts these conductors obey Ohm's law. This result, they say, is interesting, since Quincke has lately proved that for very much greater forces these substances do not obey Ohm's law: the

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departure from it being very marked. They also find that the conductivity is improved by raising the temperature. A full account of these experiments is to be communicated to the Royal Society shortly.

On Continuity of Electric Conduction. *By* Dr. JOHN HOPKINSON, *F.R.S.*

In my experiments on residual charge I touched upon the second question in Dr. Lodge's programme ('Is Ohm's law obeyed by very bad conductors?'),[1] and pointed out that Ohm's law could be regarded as a limiting case of a more general law of superposition. In the case of mechanical after-effects the law of superposition does not hold even approximately. The fourth question ('Is there any relation between optical opacity and electrolytic conductivity?') appears to me to be very intimately associated with the fact that bodies which, if they conducted, would be electrolysed do not follow Maxwell's law, whereas some other insulators do. My own present impression is that an electrical displacement in glass may, although continuous, be roughly divided into four successive stages. 1st. A yielding of the dielectric during a time corresponding to the time of wave-frequency of light, for which $K = 2\frac{1}{2}$ about. 2nd. A further yielding during a time corresponding to great absorption below the red, bringing K up to from 6 to 10. 3rd. A further slow yielding, partly recoverable, hardly sensible in time less than a second or such like, and going on with diminishing amount for days. 4th. A yielding corresponding to an actual decomposition of the material. Superposition probably applies to all these continuously connected successive events. Probably if we could experiment fast enough on any ordinary electrolyte, like solution of $CuSO_4$, we should find a similar succession of phenomena.

[Dr. Hopkinson's note is of extreme interest, and the references to his papers are as follows: Residual Charge in Leyden Jar, 'Phil. Trans.' January 1877; Strain in Glass Fibre, 'Proc. Roy. Soc.' October 4, 1878; Refractive Index and Specific Inductive Capacity, 'Phil. Mag.' April 1882. This last paper I may abstract thus:—

Maxwell's laws are that $\mu^2 = K$, and that transparent bodies must insulate. They are true for mineral oils and solid paraffin; not true for glass, Iceland spar, and organic oils. Consider, for instance, light flint glass: K is 6·7 for disturbances whose period is longer than 10^{-5} second, and for these disturbances it behaves as an insulator. It ought, therefore, for such waves to be transparent, and to have an index 2·6. But, for disturbances of period about 10^{-15} second, its index, reckoned for very long waves by extrapolation formula, comes out about 1·5. Is there any way of accounting for this discrepancy? Yes; perhaps by the known fact that on waves *between* these two periods glass exercises a strong selective absorption, and that this is usually accompanied by anomalous dispersion; which at once renders all empirical reasoning towards the state of things for very long waves, from the observed condition for very short waves, utterly futile and misleading. Perhaps, therefore, Maxwell's law is after all obeyed by these substances for long waves; and one way to test the question is by using rays from a thermopile to a freezing mixture. O. L.]

On Diathermancy and Electrolytic Conductivity.
By SHELFORD BIDWELL, *F.R.S.*

The following is one of the questions suggested by Dr. Lodge for the consideration of the Committee on electrolysis:—Is there any relation between optical opacity and electrolytic conductivity?[2]

Assuming that 'optical opacity' is included in the more comprehensive term 'opacity to radiation,' I have endeavoured to ascertain experimentally whether

[1] See *Brit. Assoc. Report* for 1885, p. 765.
[2] *Ibid.* p. 768.