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THE THEORY OF CHEMICAL ACTION IN ELECTRICAL DISCHARGE¹

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THAT slow chemical action accompanies various types of electrical discharge in many gases has been long known. Berthelot² summarized and reviewed the earlier as well as his own work, in which the arc, spark or silent discharges were applied to a large number of gases or gaseous mixtures. At that time little or no attempt was made to find a general mechanism or theory. This is not surprising if we remember that almost nothing of our present ideas of discharge in gases was then known. While some of the early results have not been confirmed by later work, most of them have been, and many of the unusual products have also been found in other ways, for example, under α radiation, proving that the early work of Berthelot, Thenard, Brodie and their contemporaries offers many valuable leads and forms a basis for further progress.

Naturally the first attempts to find a theory for the electrochemical effects in gases were directed toward a correlation between the current flowing and the amount of action produced according to Faraday's law. The disagreement found in the exhaustive researches of Warburg and of others, while unexpected, was so unmistakable that these efforts had to be abandoned.

The theories advanced since then attribute the effects to one of the following agencies: (1) Photochemical; (2) Static ions; (3) Critical activation by kinetic ions. Upon failing to find a relation between current and chemical effect, Warburg quite early adopted the idea that ozone formation, for example, might be due to the ultra-violet light accompanying the discharge. In his review³ of the subject in 1925 he still adhered to this hypothesis.

The equality of ozonization and ionization of oxygen by means of Tesla discharge convinced Krüger in 1912 of a static-ion theory of ozone formation. Simultaneously a study of ozonization under α radiation led me to the same conclusion, and to a generalization of this theory (as also Krüger) to explain all

¹ The presidential address, presented at the fifty-third general meeting of the American Electrochemical Society at Bridgeport, Conn., April 26, 1928. Colin G. Fink in the chair.

² M. Berthelot, "Essai de Mécanique Chimique," Vol. II, Chap. 11 (Dunod, Paris, 1879).

³ Zeit. f. techn. Physik., 1925, p. 625.

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