If we imagine some reaction—such, for example, as the combination of colouring matter with a tissue—influenced in one set of experiments by nickelous sulphate, and in an altogether different set by an equal weight of cobaltous sulphate, we can hardly conceive any ground for the development of a reciprocal function, such as we have experimentally traced. On the other hand, it seems reasonable to suppose that, when two bodies are simultaneously confronted with a single reagent, they both contend for its effect. Thus a chemical antagonism may arise between them by virtue merely of their being together; and thence the reciprocal function. So far as we are aware, the only other chemical function of the kind, hitherto investigated, is to be found in Chižyński's* examination of the partial precipitation, by ammonic phosphate, of mixed calcic and magnesic chlorides. That chemist arrived at the conclusion, for which we consider his evidence to be adequate, that "equal masses of calcic and magnesic chlorides have always equal, but oppositely active, coefficients of affinity."

X. "On the Formation of Hydrocyanic Acid in the Electric Arc." By James Dewar, M.A., F.R.S., Professor of Chemistry to the Royal Institution. Received June 5, 1879.

A series of experiments favouring the conclusion that the so-called carbon lines are invariably associated with the formation of acetylene† induced me to make some experiments to ascertain whether this substance can be extracted from the electric arc, which invariably shows this peculiar spectrum at the positive pole, when it is powerful and occasionally intermittent. For this purpose the carbons were used in the form of tubes, so that a current of air could be drawn by means of an aspirator through either pole, and the products thus extracted from the arc, collected in water, alkalies, and other absorbents. Gases may be led through one of the poles, and suction induced through the other, in order to examine their effect on the arc.

The following experiments record the results obtained by means of the Siemens and de Mériten's magneto-machines.

Experiment 1.—Drew a current of air by an aspirator through the drilled negative carbon, and passed the gases through potash, and iodide of potassium, and starch paste; found no nitrites; potash contained sulphides.

Experiment 2.—Hydrogen led in by the positive pole and the gases extracted as above, gave the well-known acetylene compound with

* Ann. Ch. Pharm., Supp. iv, 226—253.

† As suggested by Plücker, Ångström, and Thalén.

ammoniacal sub-chloride of copper; while, at the same time, a wash-bottle containing water gave distinct evidences of the presence of hydrocyanic acid.

Experiment 3.—Hydrogen flame burning alone gave no sulphides or hydrocyanic acid, the condensed water in a small bulb gave nitrites.

Experiment 4.—Air drawn through the negative carbon gave considerable quantities of hydrocyanic acid, which was greatly increased by extracting the gases through the positive carbon. Air was aspirated at the rate of about one litre per minute.

Experiment 5.—The same carbons used with de Mériten's magneto-machine gave no result.

Experiment 6.—Carbons purified in chlorine and hydrogen gave with de Mériten's nothing; with Siemens' and a draught of air through the negative pole, a small quantity of hydrocyanic acid, but a larger yield when the positive was used. The gases extracted after the absorption of the hydrocyanic acid contained acetylene. If the carbons are not purified, sulphuretted hydrogen is always found along with other gases.

The inference to be drawn from the above experiments is that the high temperature of the positive pole is required to produce the reaction, which is in all probability the result of acetylene reacting with free nitrogen, as when induction sparks are passed through the mixed gases, viz.—

$$C_2H_2+N_2=2HCN,$$

and that the hydrogen is obtained from the decomposition of aqueous vapour, and the combined hydrogen in the carbons. It is possible that traces of alkaline salts in the carbon poles may favour the formation of hydrocyanic acid, but, as all attempts to purify the poles so as to stop the reaction failed, I am inclined to believe it is a direct synthesis. The acetylene reaction is one of the many remarkable syntheses discovered by Prof. Berthelot of Paris. The presence of sulphuretted hydrogen is doubtless due to the reduction of the sulphates, invariably present in the ash of the carbon.

A more complete examination of the various reactions to be brought about by means of the Siemens arc, and with poles of varied composition, and in presence of different gases, will be communicated to the Society in a subsequent paper.

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