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XLVIII. *On the Solution of various Kinds of Steel and Iron in Acids; and on the Nature of the Residuums left by them.* By M. KARSTEN*.

THE action of the acids on steel depends on the *degree of hardness* which the steel has received. Steel, hardened to the utmost of its capacity, is dissolved with very great difficulty and slowness in diluted acids. In diluted muriatic acid, it becomes covered after a few days with a black powder; and the solution makes so little progress within the space of several weeks, that it would seem to require many months before it is completed. White raw iron shows absolutely the same habitudes as steel, only that the effects are more striking. Diluted muriatic or sulphuric acids have scarcely any effect on this kind of iron, on which the black powder does not appear until after the expiration of several weeks. Strong muriatic acid, aided by a boiling heat, produces a solution without leaving any residuum. Sulphuric acid, under similar circumstances, leaves some carbon of a black colour and with a metallic appearance. Nitric acid at common temperatures separates black flakes, which by a longer exposure to the acid turn to a brownish-red. By boiling, a violent effervescence is produced, together with the other circumstances just mentioned.

Very different from this are the habitudes of gray raw iron to the acids. Diluted muriatic and sulphuric acids act but very slowly, and leave at the lapse of *several months* a residuum containing carbon in very different conditions. One part consists of very thin leaves or scales, of a perfectly metallic appearance and strong lustre. They resist the effects of acids and alkalies of every description, are not in the least attracted by the magnet, and are very slowly consumed in a red-hot platinum crucible. This body has been long known as graphite. Another part of the carbon has indeed also the graphitic appearance, but is subject to magnetic influence, and is in every respect like the residuum left by soft steel when treated with the acids. A third portion, in fine, has a black colour, is not magnetic, colours a caustic alkaline solution black, and is consumed before the crucible becomes ignited. Among these three bodies the graphite is never missing; whilst, of the two other combinations, one only generally appears in the residuums.

Strong muriatic acid produces a more rapid solution, rendered still more so by boiling. The hydrogen disengaged by it, mechanically carries up the graphite with it in the solu-

* From Schweigger's *Journal*, Band xiii. p. 335.

tion.

tion. The residuum contains carbon in a state different from the graphite; but gray raw iron can never be dissolved in muriatic acid without leaving it. Strong sulphuric acid, employed under similar circumstances, leaves, besides the graphite, black carbon easily combustible and not subject to the magnetic attraction.

Nitric acid of specific gravity 1.3 does not operate strongly on gray raw iron at common temperatures. At the same time effects are produced which appear to coincide, sometimes with those exhibited by hard steel, and sometimes with those characteristic of soft steel. The former appear in the darkest and softest and most ductile gray raw iron, and the latter in the lighter coloured and at the same time less soft and ductile kind of this metal. The action of the acid appears to be interrupted; for the solution seems to cease from time to time entirely, but re-appears with great violence on the breaking off of a leaf of graphite. The same appearance takes place in a boiling temperature; and the violent progress of the solution—which however only lasts for a few seconds—is combined with the falling off of a leaf of graphite: so that the graphite must actually form a mechanical impediment, protecting the iron against the attacks of the acid, and rendering the solution so difficult, that at common temperatures it is only affected in several weeks; and at a boiling heat, in several hours. The colouring of the acid proves that part of the carbon contained in the iron is dissolved: the residuum seldom consists of pure graphite, but mostly of graphite with more or less of carbon changed into a brown powder.

In order to explain these appearances attending the solution of different kinds of iron in acids, it is necessary to find out the nature of the substances which separate during the process of solution. The graphite being insoluble in acids and alkalis, may be stated to be quite pure. In a strong red-heat and exposed to the atmosphere it is volatilized slowly, without leaving any residuum. In order to volatilize 18 grains of graphite under the muffle of an assaying-furnace four hours were required, although the muffle was kept during the whole time at a white heat. This rather considerable quantity of graphite left on the platinum plate, on which it had been spread in order to give the heated air a greater scope for action, only a trace of silica, perfectly white, which had escaped the effect of the alkaline solution. In this process of combustion the graphite gradually decreases in bulk, and disappears at last without any kind of flame being perceptible. If the process be interrupted, the only difference seen between the part of the graphite calcined and that which is not, is, that the leaves

of the former, if held against the light, appear transparent in some places, and exhibit a peculiar fibrous structure, which the non-calced graphite does not possess. Melted with nitre, the graphite produces no vehement detonations, but is consumed slowly, and the remaining salt dissolved without residuum by water. I did not succeed in converting sulphate into sulphite of potash by means of graphite. Thus then the graphite in gray raw iron is not what it has been supposed to be, a combination of carbon and iron; but pure carbon, or its metallic base. Whether natural graphite be also a pure carbon-metal, or really a combination of carbon and iron, is yet to be determined.

XLIX. *Extract from a Letter addressed by Professor BESSEL to Professor SCHUMACHER, relating to the Greenwich Observations*, as criticized in the Philosophical Magazine for November and December 1824.*

WHEN I had the pleasure of being your guest at Altona, you showed me the numbers of the Philosophical Magazine which contain a very severe censure of the Greenwich observations for 1821. I saw this censure with some surprise, because I had always considered the collection of observations at Greenwich as singularly valuable, and as a rich source of astronomical truths; nor were you, I believe, of a different opinion; and we were perfectly agreed respecting the unimportance of the inaccuracies that were imputed to this work in the two papers published in the 64th volume of the Philosophical Magazine.

For those who are acquainted with the Greenwich observations, and who compare them with the critic's remarks, every further explanation would be superfluous. But since it may be supposed that these remarks will fall into the hands of many persons not deeply versed in astronomy, I readily comply with the request which you made, that I would commit to writing our common view of the subject. I feel, as well as yourself, the propriety of doing my best on the occasion, in order that too great importance may not be attached to this censure of an establishment, to which astronomy is indebted for a great proportion of its advancement; and that its importance cannot be very great, is sufficiently shown by the facility with which Mr. Olufsen has computed the declinations of the fundamental stars, as published in the *Nachrichten*, No. 73, from the Greenwich observations for 1822.

* From the Astronomical and Nautical Collections in the Journal of Science, &c. vol. xx. p. 108.—The passages within brackets are as given in the Collections.