

While on the subject of carbon determination, it may be well to call attention to two other matters of detail. The writer has recently seen copper oxide for combustion which, instead of having the usual dead-black color and porous appearance, had a reddish color and semi-fused appearance and was not as effective as an oxidizer.

The copper oxide for the small brass tube should be as fine as possible (free, of course, from powder), consistent with keeping the tube open and free. In filling the tube, unless special care is taken, the copper oxide particles may become wedged in spots, leaving empty spaces in the tube. The filling should be slow, using only a little copper oxide at a time and testing it constantly with a wire to be sure the tube is full in every part where it is to be heated.

Where water-bottles are used for furnishing the air-pressure it is well to use water in which a little cupric sulphate has been dissolved. The solution is filtered and, being an inhospitable field for bacterial activity, remains clear and free from the carbonaceous gases which are given off from stagnant water in sufficient amount to affect carbon determinations.

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The Color Test in High Carbon Steels.—Parker says of it that it is "liable to great variations";¹ Galbraith that it "should be abandoned";² Tucker, that "its inaccuracy is well recognized";³ Hadfield that "it had long been a matter of knowledge in the Sheffield steel trade, that the color test was apt to give misleading results";⁴ Metcalf in his book "Steel" characterizes it as "the wildest guess work in the best hands." Campbell in his book "The Manufacture and Properties of Iron and Steel," and elsewhere, repeatedly and emphatically expresses distrust of the method.

It is the writer's experience also that the color method as usually carried out is unreliable. The same drillings do not always dissolve to the same shade. This difficulty can only be overcome by the use of two precautions not generally known and practiced. (1) One gram must be taken.⁵ (2) The acid must, before using,

¹ *Chem. News*, 42, 88.

² *Journal Iron and Steel Institute*, 181, 234.

³ *Ibid.*, 96, 1, 137.

⁴ *Ibid.*, 96, 2, 187.

⁵ Weighed out into a 41 cc. test-tube provided with a mark at 25 cc. Twenty cc. acid is used for solution. After cooling, the liquid is diluted to the mark, mixed by placing the thumb over the tube and inverting a number of times, and scc. withdrawn for comparison.

be made ice-cold by immersing a beaker of it in a larger beaker of ice and water for some time; it must be added all at once, and, instead of simply having the test-tube stand in cold water, it must be moved rapidly and vigorously around in a large beaker of ice-water for a minute after the addition of the acid, and before standing in the water-bath filled with cold (not necessarily ice-cold) water.¹ Dissolving in this way, no violent action takes place; loss of hydrocarbon gas is avoided—or if there is loss, it is a uniform one; and reasonable accuracy for practical purposes is insured. Results, however, are still not so reliably accurate as by combustion, for the reason that even in the same kind of steels the proportion of hardening carbon (which gives no color in the color test) to carbide carbon is not always the same. Fifty consecutive heats of high-carbon open-hearth steel, tested in the manner above described, and also by combustion, showed forty-eight fairly good results by the color method (mostly within 0.03 per cent. of the truth—a few to 0.04 per cent.), and two results (duplicated by both methods) 0.06 per cent. wide of the truth. The standard should be made up of drillings from many different heats mixed together, as was the case here. Crucible steel would show less variation in proportion of hardening to carbide carbon.

GEORGE AUCHY.

NEW BOOKS.

DES INDUSTRIES CHIMIQUES ET PHARMACEUTIQUES. PAR ALBIN HALLER, Membre de l'Institut, Professeur à la Faculté des Sciences de Paris, Rapporteur du Jury de la Classe 87 à l'Exposition Universelle de 1900. Paris: Gauthier-Villars, 1903. 2 vols. quarto. Vol. I, lxxxix + 405 pp. Vol. II, 544 pp. Price, 20 francs.

Perhaps nothing more strikingly illustrates the enormous development of technical chemistry in the last generation than does a comparison of this work of Haller with the famous *Bericht* of A. W. Hofmann, published after the Vienna exposition of 1873. The work of Hofmann was a masterpiece in its way and is still the authority which must be studied in any discussion of the development of chemical manufactures. The number of exhibitors of chemical products at Vienna was not great, but, in discussing the things there shown, opportunity was taken to give a pretty full

¹ If the violent action be prevented at the very start it does not occur at all.