THE OXYGEN CONTENT OF OPEN-HEARTH STEEL.

M UCH study has been devoted to the systematic examination of the oxygen content of commercial steels with a view to collecting trustworthy evidence as to the amount of oxygen to be expected normally in good class material, and the limits within which it is desirable to restrict this element. The following data are from a paper read last fall before the Iron and Steel Institute by Messrs. J. A. Pickard and F. M. Potter :--

All the steels examined had been made by either the acid or the basic open-hearth process, and, as far as could be judged from their analyses, they were generally of excellent quality. In the accompanying tables the samples are arranged in order of carbon content. The actual figures obtained for oxygen in duplicate analyses are given in the last two columns, and show the amount of agreement ordinarily obtained when using this method.

It had been expected from previous results that it might be possible to discover some relationship between the oxygen and the carbon content, but the results quoted lend but little support to this theory. One most important conclusion to be drawn is that it is possible to make all kinds of open-hearth steel, even low-carbon low-silicon basic (No. 9), practically free from oxygen—containing only 0.010 per cent. or under. That some steels are made containing more than that amount is, however, abundantly shown by the other results, and it is to be observed that the cheaper steels contain higher oxygen.

Acid open-hearth steel is generally admitted to be of better quality than basic open-hearth, and it has been suggested that this is due to the higher oxygen content in basic steel. In the tables all the high-oxygen steels (that is, over 0.020 per cent.) except one (No. 2) are found in the basic group, so that the evidence does support the conclusion that basic steel is higher in oxygen. It is to be noted, however, that only two of the basic steels are higher in carbon than the lowest of the acid group, and no marked difference is to be noted in those samples comparable in carbon content; indeed, No. 2, and acid steel, is higher in oxygen than Nos. 23, 25, and 26, which are basic.

An interesting question is raised by the fact that the samples that must have received most hot-working are all high in oxygen. Nos. 14 and 15 were taken from two fishplates, No. 22 from a rail, while the other samples were from fair-sized billets. The possibility that the oxygen content may vary after the steel has solidified has not hitherto been considered, so far as the authors are aware. It must be borne in mind, however, that these

Table I.-Acid Open-hearth Steel.

Sample.	Carbon, per cent.	Manganese, per cent.	Silicon, per cent.	Sulphur, per cent.	Phosphorus, per cent.	Oxygen, i.	per cent. ii.	
I	0.67	0.73	0.95	0.035	0.027	0.004	0.004	Mean—
2 ·	0.79	0.65	0.210	0.030	0.050	0.020	0.021	Carbon, 0.87
3	0.93	0.68	0.035	0.031	0.027	0.007	0.006	Oxygen, 0.011
4	1.08	0.62	0.024	0.033	0.022	• 0.012	0.016	Mean—
5	1.18	0.65	0.056	0.027	0.025	0.005	0.006	Carbon, 1.35
6	1.33	0.42	0.140	0.030	0.024	0.004	0.007	Oxygen, 0.007
7	1.55	0.49	0.100	0.027	0.026	0.010	0.012	Mean of all— Oxygen, 0.0096

Table II.—Basic Open-hearth Steel.

Sample.	Carbon, per cent.	Manganese, per cent.	Silicon, per cent.	Sulphur, per cent.	Phosphorus, per cent.	Oxygen, per cent. i. ii.		
8	0.10					0.038	0.036	
9	0.14	0.35	0.020	0.033	0.018	0.010	0.011	
10	0.20					0.031	0.028	
II	0.23	0.70		0.060	0.026	0.013	0.014	Mean
12	0.26	0.49	0.120	0.030	0.031	0.003	0.006	Carbon, 0.25
13	0.30					0.030	0.027	Oxygen, 0.021
14	0.32	0.62		0.051	0.020	0.040	0.041	
15	0.33	0.62		0.057	0.025	0.024	0.021	
16	0.35	0.56	0.182	0.027	0.020	0.005	0.008	
		0.30						
17	0.41	0.52	0.026	0.032	0.023	0.019	0.014	
18	0.44					0.029	0.025	
19	0.54	0.69	0.085	0.022	0.024	0.003	0.003	Mean—
20	0.55	0.97		0.055	0.011	0.016	0.017	Carbon, 0.52
21	0.55					0.020	0.020	Oxygen, 0.021
22	0.61	0.74		0.053	0.021	0.038	0.044	
	0.01	0.74	1.000	00				Mean—
23	0.66	0.65	0.100	0.033	0.052	0.005	0.006	Carbon, 0.81
24	0.75	0.38	0.025	0.025	0.022	0.025	0.026	Oxygen, 0.011
25	0.75	0.67	0.096	0.030	0.028	0.004	0.007	Mean of all—
26	I.00	0.67	0.036	0.016	0.025	0.006	0.007	Oxygen, 0.0189
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