only slightly, if at all, diminished. Similar results have been obtained with preparations from other sources.

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RECEIVED AUGUST 2, 1934

THERMAL DIFFUSION OF GASES NEAR A HOT METAL SURFACE

Sir:

In an experimental study of the equilibrium of molten iron and steam [THIS JOURNAL, **55**, 3131 (1933)] the only criterion of equilibrium was the fact that the oxygen content of the iron reached a constant and reproducible value at a constant steam–hydrogen ratio. The surprising results of Emmett and Shultz [*ibid.*, **55**, 1376 (1933)], in which a thermal separation of steam and hydrogen was observed even in a flowing system, raised the question as to whether such a phenomenon could have occurred in our experiments. This suspicion was heightened by the fact that for a given oxygen content of the liquid iron the observed ratio of steam to hydrogen was consistently a little higher than that calculated from the ratio CO_2:CO found by Vacher and Hamilton [*Trans. Am. Inst. Mining Met. Eng.*, **95**, 124 (1931)].

It should be possible to diminish the temperature gradient and thereby also the amount of thermal separation by preheating the gas stream as it approaches the hot metal surface. The preheating due to radiation from the liquid iron will be the more efficient the lower the lineal velocity of the gases. In the earlier experiments the gases were introduced through a 3-mm. tube at 250 to 450 cc. per minute, whereas Vacher [*Bur. Standards J. Res.*, **11**, 541 (1933)], using a larger tube and lower rate of flow, obtained a lower ratio of steam to hydrogen.

A series of experiments has been conducted in which the steam–hydrogen mixture was admitted through a 7-mm. tube containing an electrically heated spiral of platinum wire. In another series this preheating was supplemented by a cast chromium sleeve which fitted over the top of the crucible containing the melt and which was heated by induction to a temperature approximating that of the liquid iron. The results of these experiments at 1600° and 0.065% oxygen in the liquid iron are given in Table I. The temperature recorded for the platinum coil is its average determined by its resistance. The end nearest the exit was several hundred degrees hotter. The recorded sleeve temperatures are estimates.

TABLE I

THE EQUILIBRIUM: FeO (IN Fe) + H_2 = Fe(l) + H_2O AT 1600°

Expt.	$\frac{p_{H_2O}}{p_{H_2} \times \%O}$	Flow cc./min.	Coil temp., °C.	Conditions
1–18	4.75	300	..	3-mm. tube
33	4.58	300	..	7-mm. tube
34	4.33	300	1170	No sleeve
35	4.23	300	1320	No sleeve
51	4.20	300	1170	Sleeve about 1500°
52	4.04	300	1170	Sleeve about 1600°
53	3.94	200	1170	Same as 52
55	4.20	450	1050	No sleeve

The results substantiate the hypothesis of partial thermal separation of the cold gases near the hot metal surface, which results in a diffusion of steam away from the surface and a low oxygen content of the liquid iron. In experiments 52 and 53 the preheating is believed to have been sufficient to largely eliminate this source of error. These two experiments are also in very good agreement with calculations from similar data on the system Fe:C:O.

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RECEIVED AUGUST 9, 1934

MAGNETIC SUSCEPTIBILITY OF METAL KETYLS

Sir:

We have recently made an investigation on the magnetic susceptibilities of some of the metal ketyls in solution by the Gouy method. The root mean square permanent magnetic moment per molecule was calculated from the molal susceptibility χ_M of the solute by means of the Langevin relation

$$\mu = 2.83\sqrt{T(\chi_M - N\alpha)}$$

μ being in Bohr magnetons. The values of $N\alpha$ were found by Pascal's rule from values in the "International Critical Tables." The percentage dissociation of the metal ketyls under the conditions given in the table below was calculated from the relation

$$D = 100\ (\mu^2/3)$$

which follows from the assumption that the radicals have a magnetic moment of $\sqrt{3}$ Bohr magnetons.