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Equilibrium between Sulphur in Molten Iron and Mixed gas of H₂ and H₂O

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(Received Aug. 31, 1951)

Introduction

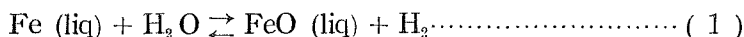
In this report, the author will describe the action of mixed gas of H₂ and H₂O against sulphur in molten iron. Equilibrium between sulphur in molten iron and mixed gas of CO and CO₂ has been previously reported by the author.¹⁾

Compared to the action of mixed gas of CO and CO₂ that of H₂ and H₂O is less important but can not be neglected in the iron and steel making process.

As the reaction products of sulphur in molten iron and mixed gas of H₂ and H₂O, H₂S, SO₂ and S₂ are considered in gas atmosphere. Some molten iron should be oxidized to FeO (liq), but it is not necessary to consider the higher oxides of Fe.

As H₂O content in the mixture increases, oxygen in molten iron also increases and at last it reaches its saturation point and molten FeO floats on the molten iron. Equilibrium relation of the formation of FeO has been recently determined by Sanbongi.²⁾

That is,



$$\log K_1 = \log p_{\text{H}_2}/p_{\text{H}_2\text{O}} = -2757.52/T + 1.8856 \dots\dots\dots (2)$$

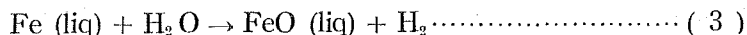
By this equation, equilibrium gas content can be calculated as follows:

temp. °C	1500	1600	1700
log p _{H₂} /p _{H₂O}	0.3304	0.4134	0.4880
H ₂ %	68.15	72.15	75.47
H ₂ O %	31.85	27.85	25.53

Therefore when H₂ content at these temperatures is less than that shown in the table, molten iron is saturated with oxygen, and molten FeO floats on molten iron.

When H₂ content is higher, molten iron dissolves oxygen corresponding to p_{H₂}/p_{H₂O} but FeO layer can not exist. Considering the true equilibrium state, as long as molten iron exists, H₂ content of mixed gas must be higher than that shown in

the table. But when mixed gas of higher H_2O content acts on molten iron, gas atmosphere reaches the equilibrium forming molten FeO. Therefore the reaction

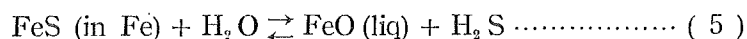
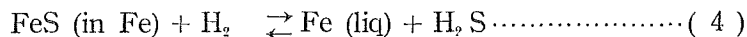


must be considered as a way to the equilibrium.

Then the gaseous products in the range of FeO forming are not said to be the products of true equilibrium.

Formation of H_2S

On the formation of H_2S from sulphur in molten iron, the following reactions are considered:



Reaction (4) has been determined by the author as follows.³⁾

$$\log K_4 = \log p_{H_2S}/p_{H_2} \cdot [S] = -4427/T + 0.113 \dots\dots (6)$$

From this equation, values of $\log K_4$ at 1500°C, 1600°C and 1700°C are calculated as follows.

temp. °C	1500	1600	1700
$\log K_4$	-2.384	-2.251	-2.131

As reaction (5) is obtained by combining reaction (4) with (1), from equations (6) and (2)

$$\log K_5 = \log p_{H_2S}/p_{H_2O} \cdot [S] = -7184.52/T + 1.9986 \dots (7)$$

is introduced and values of $\log K_5$ can be calculated as follows:

temp. °C	1500	1600	1700
$\log K_5$	-2.054	-1.837	-1.643

From (6) and (7), the following equations can be obtained:

$$\log p_{H_2S} = \log K_4 + \log p_{H_2} + \log [S] \dots\dots\dots (8)$$

$$\log p_{H_2S} = \log K_5 + \log p_{H_2O} + \log [S] \dots\dots\dots (9)$$

Then if the temperature was constant, $\log p_{H_2S}$ is determined by $\log p_{H_2}$ or $\log p_{H_2O}$ and $\log [S]$.

When $p_{H_2} + p_{H_2O} = 1$, $\log p_{H_2S}$ are calculated as follows.

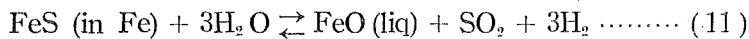
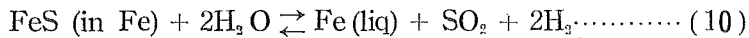
H ₂ %	99	95	90	80	70	50	30	20	10	5	1	
H ₂ O%	1	5	10	20	30	50	70	80	90	95	99	
S %	log p _{H₂S}											
1500°C	1	-2.388	-2.406	-2.430	-2.481	-2.539	-2.355*	-2.209*	-2.151*	-2.100*	-2.076*	-2.058*
	0.5	-2.689	-2.707	-2.731	-2.782	-2.840	-2.656	-2.510	-2.452	-2.401	-2.377	-2.359
	0.1	-3.388	-3.406	-3.430	-3.481	-3.539	-3.355	-3.209	-3.151	-3.100	-3.076	-3.058
	0.05	-3.689	-3.707	-3.731	-3.782	-3.840	-3.656	-3.510	-3.452	-3.401	-3.377	-3.359
	0.01	-4.388	-4.406	-4.430	-4.481	-4.539	-4.355	-4.209	-4.151	-4.100	-4.076	-4.058
1600°C	1	-2.255	-2.273	-2.297	-2.348	-2.361*	-2.139*	-1.993*	-1.935*	-1.884*	-1.860*	-1.842*
	0.5	-2.556	-2.574	-2.598	-2.649	-2.662	-2.440	-2.294	-2.236	-2.185	-2.161	-2.143
	0.1	-3.255	-3.273	-3.297	-3.348	-3.361	-3.139	-2.993	-2.935	-2.884	-2.860	-2.842
	0.05	-3.556	-3.574	-3.598	-3.649	-3.662	-3.440	-3.294	-3.236	-3.185	-3.161	-3.143
	0.01	-4.255	-4.273	-4.297	-4.348	-4.361	-4.139	-3.993	-3.935	-3.884	-3.860	-3.842
1700°C	1	-2.135	-2.153	-2.177	-2.228	-2.166*	-1.944*	-1.798*	-1.740*	1.689*	-1.665*	-1.647*
	0.5	-2.436	-2.454	-2.478	-2.529	-2.467	-2.245	-2.099	-2.041	-1.990	-1.966	-1.948
	0.1	-3.135	-3.153	-3.177	-3.228	-3.166	-2.944	-2.798	-2.740	-2.689	-2.665	-2.647
	0.05	-3.436	-3.454	-3.478	-3.529	-3.467	-3.245	-3.099	-3.041	-2.990	-2.966	-2.948
	0.01	-4.135	-4.153	-4.177	-4.228	-4.166	-3.944	-3.798	-3.740	-3.689	-3.665	-3.647

In this table the mark (*) shows the results in the field in which molten FeO is produced.

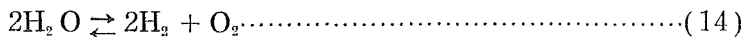
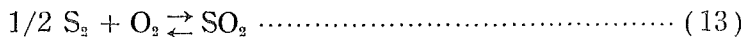
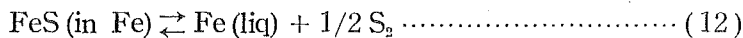
From this table, Fig 1 ~ Fig 3 can be obtained.

Formation of SO₂

On the formation of SO₂ by the reactions between sulphur in molten iron and the mixed gas of H₂ and H₂O, two reactions are considered.



Reaction (10) can be introduced by combining the following three equations.



Reaction (12) has been determined by the author as follows.³⁾

$$\log K_{12} = \log p_{\text{S}_2}^{1/2} / [\text{S}] = -9174.3/T + 2.705 \dots\dots\dots (15)$$

The equilibrium constant of reaction (13) has been precisely determined by Lewis & Randall⁴⁾ and Schenck⁵⁾ gave the following equation:

$$\log K_{13} = \log p_{SO_2}/p_{S_2}^{1/2} \cdot p_{O_2} = 18215/T - 1.39 - \log T + 0.61 \times 10^{-3}T - 0.068 \times 10^{-6}T^2 - 0.20 \dots \dots \dots (16)$$

Calculating log K₁₃ between 1400°C ~ 1900°C, the author gave a simple equation for this reaction.

$$\log K_{13} = \log p_{SO_2}/p_{S_2}^{1/2} \cdot p_{O_2} = 18115.9/T - 3.79 \dots \dots \dots (17)$$

This equation agrees well with equation (16) in this temperature range.

The equilibrium constant of the reaction (14) has been given by Schenck,⁶⁾

$$\log K_{14} = \log p_{C_2} \cdot p_{H_2}^2/p_{H_2O}^2 = -24900/T + 2.335 \log T - 0.965 \times 10^{-4}T + 0.137 \times 10^{-6}T^2 - 0.665 \times 10^{-10}T^3 + 0.1907 \times 10^{-17}T^5 - 2.17 \dots \dots (18)$$

In the same way the author simplified this equation and obtained the following equation :

$$\log K_{14} = \log p_{O_2} \cdot p_{H_2}^2/p_{H_2O}^2 = -25500/T + 5.675 \dots \dots \dots (19)$$

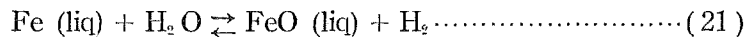
From (15), (17) and (19), for the reaction (10)

$$\log K_{10} = \log p_{H_2}^2 \cdot p_{SO_2}/p_{H_2O} = -16558.4/T + 4.590 \dots \dots \dots (20)$$

is introduced and log K₁₀ can be calculated as follows :

temp. °C	1500	1600	1700
log K ₁₀	-4.749	-4.251	-3.802

Reaction (11) is obtained by combining reaction (10) with the reaction



The equilibrium constant of this reaction (21) has been given by Sanbongi,²⁾

$$\log K_{21} = \log p_{H_2}/p_{H_2O} = -2757.52/T + 1.8856 \dots \dots \dots (22)$$

Calculating from (20), and (21) the following equation is obtained :

$$\log K_{11} = \log p_{H_2}^3 \cdot p_{SO_2}/p_{H_2O}^3 = -19315.9/T + 6.476 \dots \dots (23)$$

By this equation, log K₁₁ can be calculated as follows :

temp. °C	1500	1600	1700
log K ₁₁	-4.418	-3.837	-3.314

From above results, following equations can be introduced.

$$\log p_{SO_2} = \log K_{10} + 2 (\log p_{H_2O} - \log p_{H_2}) + \log [S] \dots \dots \dots (24)$$

$$\log p_{SO_2} = \log K_{11} + 3 (\log p_{H_2O} - \log p_{H_2}) + \log [S] \dots \dots \dots (25)$$

Therefore, log p_{S₂} is a function of log p_{H₂O}—log p_{H₂}, or p_{H₂O}/p_{H₂}, and [S].

When p_{H₂O} + p_{H₂} = 1, log p_{S₂} is calculated as follows.

H ₂ , %	99	95	90	80	70	50	30	20	10	5	1	
H ₂ O, %	1	5	10	20	30	50	70	80	90	95	99	
S %	log p _{SO₂}											
1500°C	1	-8.741	-7.307	-6.657	-5.956	-5.485	-4.418*	-3.314*	-2.612*	-1.556*	-0.581*	1.570*
	0.5	-9.042	-7.608	-6.958	-6.257	-5.786	-4.719	-3.615	-2.913	-1.867	-0.882	1.269
	0.1	-9.741	-8.307	-7.657	-6.956	-6.485	-5.418	-4.314	-3.512	-2.556	-1.581	0.570
	0.05	-10.042	-8.608	-7.958	-7.257	-6.786	-5.719	-4.615	-3.913	-2.867	-1.882	0.269
	0.01	-10.741	-9.307	-8.657	-7.956	-7.485	-6.418	-5.314	-4.612	-3.556	-2.581	0.430
1600°C	1	-8.243	-6.809	-6.159	-5.458	-4.987*	-3.837*	-2.733*	-2.031*	-0.975*	0.000*	2.151*
	0.5	-8.544	-7.110	-6.460	-5.759	-5.288	-4.138	-3.034	-2.332	-1.276	-0.301	1.850
	0.1	-9.243	-7.809	-7.159	-6.458	-5.987	-4.837	-3.733	-3.031	-1.975	-1.000	1.151
	0.05	-9.544	-8.110	-7.460	-6.759	-6.288	-5.138	-4.034	-3.332	-2.276	-1.301	0.850
	0.01	-10.243	-8.809	-8.159	-7.458	-6.987	-5.837	-4.733	-4.031	-2.975	-2.000	0.151
1700°C	1	-7.754	-6.360	-5.810	-5.006	-4.418*	-3.314*	-2.210*	-1.508*	-0.452*	0.523*	2.674*
	0.5	-8.055	-6.661	-6.111	-5.307	-4.719	-3.615	-2.511	-1.809	-0.753	0.222	2.373
	0.1	-8.754	-7.360	-6.810	-6.006	-5.418	-4.314	-3.210	-2.508	-1.452	-0.477	1.674
	0.01	-9.055	-7.661	-7.111	-6.307	-5.719	-4.615	-3.511	-2.809	-1.753	-0.778	1.373
	0.01	-9.754	-8.360	-7.810	-7.006	-6.418	-5.314	-4.210	-3.508	-2.452	-1.477	0.674

Dissociation Pressure of S₂

Dissociation pressure of sulphur equilibrated with S content at 1500°C, 1600°C and 1700°C is calculated as follows.

S %	log p _{S₂}		
	1500°C	1600°C	1700°C
1	-4.939	-4.386	-3.890
0.5	-5.541	-4.988	-4.492
0.1	-6.939	-6.386	-5.890
0.05	-7.541	-6.988	-6.492
0.01	-8.939	-8.386	-7.890

These values have no relation to the mixing ratio of H₂ and H₂O.

Sulphur content in gas atmosphere

From the above calculations, at given H₂ % in H₂-H₂O mixture, gaseous sulphide which shows the greatest partial pressure is tabulated as follows. Besides this gas, some gaseous sulphides whose partial pressure is greater than 1/100 of the greatest are also described here.

H ₂ %	99	95	90	80	70	50	30	20	10	5	1	
H ₂ O%	1	5	10	20	30	50	70	80	90	95	99	
1500°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	1%	-2.388	-2.406	-2.430	-2.481	-2.539	-2.355	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
1500°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.5%	-2.689	-2.707	-2.731	-2.782	-2.840	-2.656	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	1.570
1500°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.1%	-3.388	-3.406	-3.430	-3.481	-3.539	-3.355	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	0.570
1500°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.05%	-3.689	-3.707	-3.731	-3.782	-3.840	-3.656	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	0.269
1500°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.01%	-4.388	-4.406	-4.430	-4.481	-4.539	-4.355	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	-0.430
1600°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	1%	-2.255	-2.273	-2.297	-2.348	-2.361	-2.139	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
1600°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.5%	-2.556	-2.574	-2.598	-2.649	-2.662	-2.440	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	1.850
1600°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.1%	-3.255	-3.273	-3.297	-3.348	-3.361	-3.139	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	1.151
1600°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.05%	-3.556	-3.574	-3.598	-3.649	-3.662	-3.440	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	0.850
1600°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.01%	-4.255	-4.273	-4.297	-4.348	-4.361	-4.139	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	0.151
1700°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	1%	-2.135	-2.153	-2.177	-2.228	-2.166	-1.944	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
1700°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.5%	-2.436	-2.454	-2.478	-2.529	-2.467	-2.245	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	2.373
1700°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.1%	-3.135	-3.153	-3.177	-3.228	-3.166	-2.944	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	1.674
1700°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.05%	-3.436	-3.454	-3.478	-3.529	-3.467	-3.245	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	1.373
1700°C	[S]	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{H₂S}	log p _{SO₂}
	0.01%	-4.135	-4.153	-4.177	-4.228	-4.166	-3.944	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	log p _{SO₂}	0.674

Only these gases described in this table have the decisive influence upon sulphur content in the gas atmosphere. From the fact that both H₂S and SO₂ contain

1430g S per 1 m³ and S₂ contains 2860g S per 1 m³, S_g contained in 1 m³ of the equilibrium gas is tabulated as follows,

H ₂ %		99	95	90	80	70	50	30	20	10	5	1	
H ₂ O %		1	5	10	20	30	50	70	80	90	95	99	
1500°C	[S] 1 %	S g/m ³	5.8530	5.6142	5.3125	4.7247	4.1341	6.3149	9.5310	13.5936	51.0081	387.244	53128.8
		log S	0.7674	0.7493	0.7253	0.6744	0.6164	0.8004	0.9791	1.1334	1.7076	2.5880	4.7253
	[S] 0.5 %	S g/m ³	2.9258	2.8091	2.6569	2.3624	2.0764	3.1575	4.7662	6.7892	25.5541	193.622	26569.4
		log S	0.4662	0.4483	0.4244	0.3734	0.3173	0.4993	0.6782	0.8324	1.4075	2.2870	4.4244
	[S] 0.1 %	S g/m ³	0.5853	0.5614	0.5313	0.4725	0.4134	0.6315	0.9531	1.3594	5.1008	38.7244	5312.88
	log S	-0.2326	-2.507	-0.2747	-0.3256	-0.3836	-0.1996	-0.0209	0.1334	0.7076	1.5880	3.7253	
	[S] 0.05 %	S g/m ³	0.2926	0.2807	0.2657	0.2362	0.2076	0.3158	0.4766	0.6789	2.5554	19.3622	2656.94
		log S	-0.5338	-0.5517	-0.5956	-0.6266	-0.6827	-0.5007	-0.3218	-0.1676	0.4075	1.2870	3.4244
	[S] 0.01 %	S g/m ³	0.05853	0.05614	0.05313	0.04725	0.04134	0.06315	0.09531	0.1359	0.5101	3.8724	531.288
		log S	-1.2326	-1.2507	-1.2747	-1.3256	-1.3836	-1.1996	-1.0209	-0.8666	-0.2924	0.5880	2.7253
1600°C	[S] 1 %	S g/m ³	8.0666	7.7435	7.3345	6.5337	6.3449	10.5906	17.1743	29.9156	170.170	1450.02	202488
		log S	0.9077	0.8889	0.8654	0.8152	0.8024	1.0249	1.2349	1.4759	1.1309	3.1614	5.3085
	[S] 0.5 %	S g/m ³	3.9754	3.8188	3.6065	3.2089	3.1145	5.2967	8.5900	14.9578	85.085	724.867	101244
		log S	0.5994	0.5819	0.5571	0.5064	0.4934	0.7240	0.9340	1.1749	1.9299	2.8603	5.0075
	[S] 0.1 %	S g/m ³	0.7494	0.7626	0.7217	0.6416	0.6228	1.0591	1.7174	2.9916	17.0170	145.002	20248.8
	log S	-0.0997	-0.1177	-0.1416	-0.1927	-0.2057	0.0249	0.2349	0.4759	1.1309	2.1614	4.3085	
	[S] 0.05 %	S g/m ³	0.3975	0.3819	0.3607	0.3209	0.3115	0.5297	0.8590	1.4958	8.5085	72.4867	10124.4
		log S	-0.4006	-0.4181	-0.4429	-0.4936	-0.5066	-0.2760	-0.0760	0.1749	0.9299	1.8603	4.0075
	[S] 0.01 %	S g/m ³	0.07949	0.07626	0.07217	0.06416	0.06228	0.10591	0.17174	0.29916	1.7017	14.5002	2024.88
		log S	-1.0997	-1.1177	-1.1416	-1.1927	-1.2057	-0.9751	-0.7651	-0.5241	0.1309	1.1614	3.3085
1700°C	[S] 1 %	S g/m ³	10.8780	10.4233	9.8827	8.8288	10.1258	17.3316	31.9462	70.7993	534.391	4767.62	675103
		log S	1.0366	1.0180	0.9949	0.9459	1.0054	1.2388	1.5044	1.8500	2.7279	3.6783	5.8294
	[S] 0.5 %	S g/m ³	5.3310	5.1194	4.8471	4.3215	4.9707	8.4826	15.8015	35.2066	267.124	2383.81	337480
		log S	0.7268	0.7092	0.6857	0.6353	0.6964	0.9285	1.1987	1.5466	2.4267	3.3773	5.5282
	[S] 0.1 %	S g/m ³	1.0479	1.0054	0.9514	0.8460	0.9749	1.6974	3.1589	7.0428	53.4391	476.762	67510.3
	log S	0.0208	0.0023	-0.0216	-0.0726	-0.0110	0.2298	0.4995	0.8477	1.7279	2.6783	4.8294	
	[S] 0.05 %	S g/m ³	0.5239	0.5027	0.4757	0.4230	0.4879	0.8483	1.5802	3.5207	26.7124	238.381	33748.0
		log S	-0.208	-0.2987	-0.3227	-0.3737	-0.3117	-0.0715	0.1987	0.5466	1.4267	2.3773	4.5282
	[S] 0.01 %	S g/m ³	0.1048	0.1005	0.09514	0.08460	0.09749	0.1697	0.3159	0.7043	5.3439	47.6762	6751.03
		log S	-0.9792	-0.9977	-1.0216	-1.0726	-1.0110	-0.7702	-0.5005	-0.1523	0.7279	1.6788	3.8294

These relations are shown in Fig. 7 ~ Fig 9.

According to these results, important gaseous sulphides produced by the reactions between sulphur in molten iron, H_2 and H_2O are H_2S and SO_2 . If the sul-

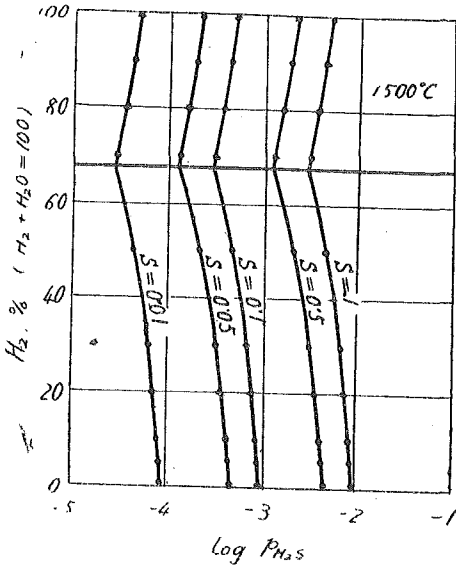


Fig. 1

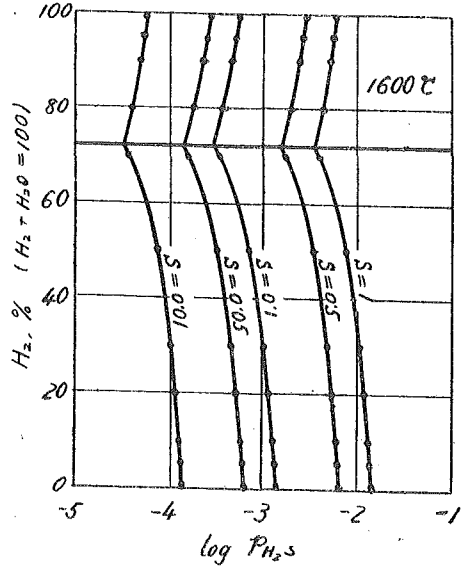


Fig. 2

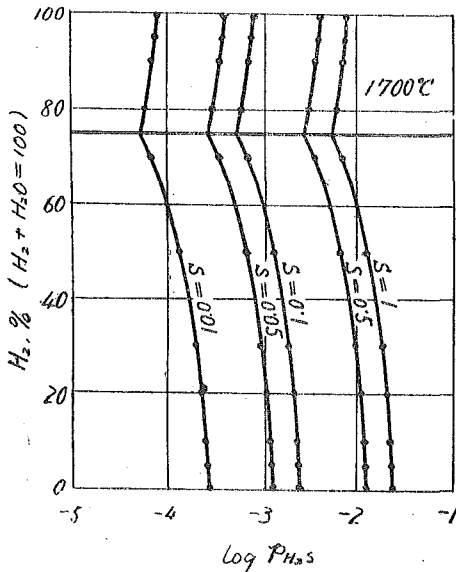


Fig. 3

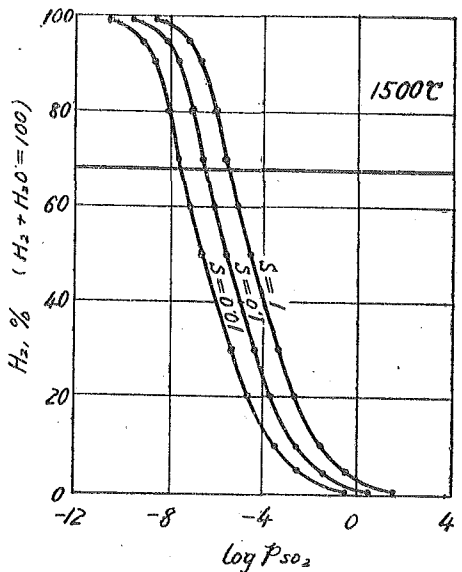


Fig. 4

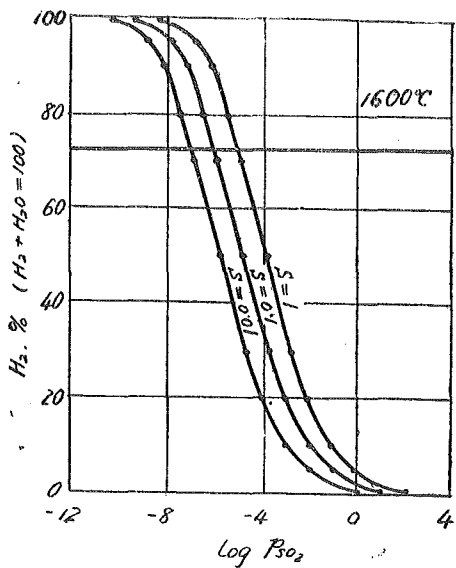


Fig. 5

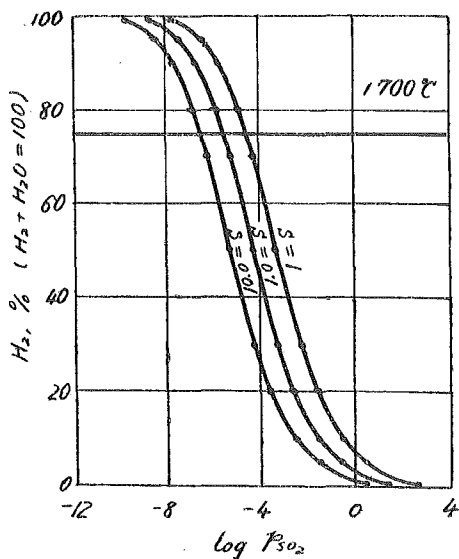


Fig. 6

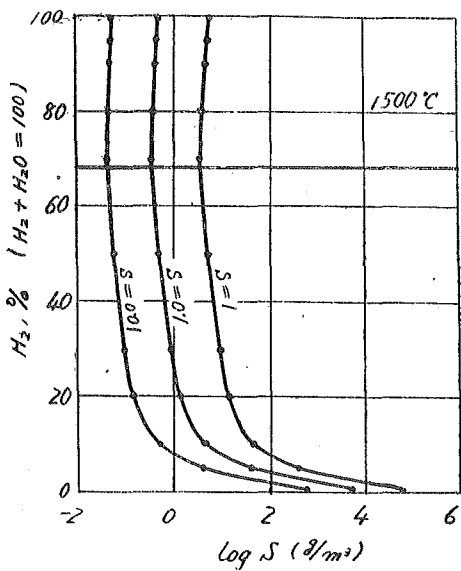


Fig. 7

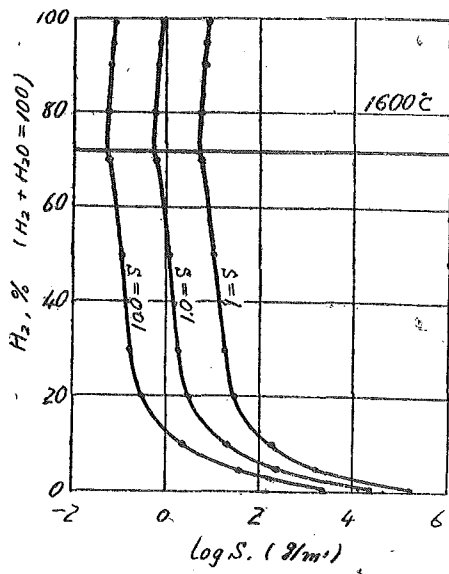


Fig. 8

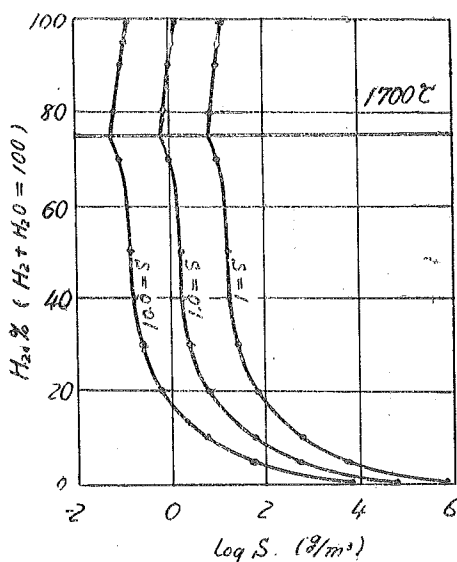


Fig. 9

phur content of molten iron was high and temperature was also high, sulphur vapor should be considered. When H_2O content in gas atmosphere is rather great, values of p_{S_2} reach very high and in these cases calculations done by the assumption that $p_{H_2} + p_{H_2O} = 1$ can not be applied in practice. But this shows that in strong oxidizing condition, much sulphur can be contained in gas atmosphere.

Conclusion

On sulphur dissolved in molten iron, the author has carried on the calculations like those reported in foregoing papers.

In this case, although H_2S , SO_2 and S_2 may be considered as sulphides in the gas atmosphere, H_2S and SO_2 are more important. When iron contains much sulphur at high temperature, vapour pressure of S_2 becomes considerably large.

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