THE LEADING PART OF HYDROGEN IN RECEPTION OF DOMAIN PIG-IRON

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Among the materials most widely used in different orbs of life activity, the special place belongs to pig-iron. It is stipulated that, that it, having low mechanical characteristics, in base is initial raw materials for reception of steel. In the event that it is necessary to attach domain pig-iron express properties, the alloy building is applied. With this purpose in him enter major additives of a chrome, a nickel, a molybdenum, a vanadium and many other alkaline, щелочноземельных and transition metals and alloys on their base (ferroalloys). This very dear way of giving to pig-iron of the necessary properties picked in all countries producers of pig-iron owing to the complete ignoring the leading part of hydrogen in reduction of oxides of iron and his heritable influence at all stages of reception, machining, operation and shattering of pig-iron and steel items.

In this connection holding the assaying of all modern process of reception of pig-iron in the blast furnace is actual. Participation of hydrogen as main reductant of oxides of iron, clouded by other elements having to ita major affinity. First of all it touches шихтовых materials. The given most out{most generated} element which is referring to to number of creators of pig-iron and steel, the calcium (blue john, a buhr, a dolomite, etc.) is. Naturally, that representations about the leading part of hydrogen in a blast-furnace smelting operation of reception of pig-iron will cause mining new expedients of action on the pig-iron melt, completely deleting graphite precipitations in solid domain pig-iron. In turn it will give in reception of a level of properties his equal or exceeding properties expensive doped.

The modern representation of a blast-furnace smelting operation in quantities publications. Practically all of them give the same responses of interaction of oxides of iron and carbonic oxide. So, for example, in the textbook on blanket metallurgy of the modern publication [1] following responses of reduction of oxides of iron are given:

«$3Fe_2O_3 + CO = 2Fe_3O_4 + CO_2$

$\Delta H_{298} = -52{,}25$ KJ , $\Delta Z° = -52130 – 41{,}00\,T$ J/mole

2. $Fe_3O_4 + CO = 3FeO + CO_2$

$\Delta H_{298} = 35{,}45$ KJ , $\Delta Z° = 35380 – 40{,}16\,T$ J/mole

3. $FeO + CO = Fe + CO_2$

$\Delta H_{298} = -13{,}20$ KJ , $\Delta Z° = -13160 + 17{,}21\,T$ J/mole»

It is considered, that the first response begins at rather low temperatures - 400C (500°C). In accordance with descent of the ore materials in the blast furnace there is more the complete reduction of oxides in this connection the temperature increases and there are requirements for a leakage of the further responses.

To hydrogen as to a reductant, not enough attention is given, or his role is considered the minor. Therefore at analysis of properties of fluidic and solid pig-iron to the present time extremely small successes are reached. However the modern representations about participation of hydrogen in shaping properties of fluidic and solid metals and as in reduction of oxides, require new standings on reception of pig-iron in the blast furnace.

Hydrogen hits in the blast furnace different ways and base of them following.

Charge materials of a blast-furnace smelting operation. A basic material for reception of pig-iron is the campanil. By viewing makeup of campanils the special attention is given a relation of the oxides attendant oxides of iron. As a rule, in campanils very low contents CaO. In subsequent by viewing all metallurgical cycle of reception of pig-iron also became a red hairline will pass change of the contents of bridgings of a calcium ($CaCO_3$, CaO, CaF_2). By many contributors it was paid attention to relation CaO/SiO_2, CaO/MgO, CaO/Al_2O_3, CaO/MnO. It is valid in definitely fine-bored plot because as it is become clear in subsequent, all metallurgy of iron will be determined by an element a calcium, distinguished by a high affinity to hydrogen. The makeup of campanils in linkage with the small contents of oxides of a calcium is poor for reception of pig-iron. To receive pig-iron, it is necessary to add to a campanil $CaCO_3$.

All fluxing stones used now for swimming trunks of pig-iron in the blast furnace are a buhr

(containing CaO 50-54 %), or a dolomitic limestone (containing CaO 38,5-42,3 %, and MgO 10,2-12,6 %).

Fuel for the blast furnace. If to scan a history of a blast-furnace practice on a stretching of hundred years it is possible to note, that the pursuit of a lump of metal withdrew from a way of the exact fathoming of substance of process of reception of pig-iron. Ledebur [2], viewing an iron smelting at the use of different combustible materials, explicitly has described following receptions: smelting on coke or xylanthrax, brown coal, peat and peat coal, crude fire-woods, with the help of gases. It has marked following: « the Crude tree in a condition to exchange major quantity of coal, than it would be gained at routine coal firing ».

Now in « the Modern blast-furnace smelting operation » the solid and gas substances representing hydrocarbons [3] are applied. Main fuel for the blast furnace following:

1. Rock gas. The contents of different builders in gas cleanly gas fields oscillates mostly in following breaking points, %:

CH_4	90-99	CH_2	0-0,3
CH_6	0,3-4,5	CO_2	0,1-1,0
C_3H_8	0,1-1,2	N_2	0,5-3,0
C_4H_{10}	0,1-0,8		

2. Coke-oven gas. On the modern by-product coke plants the makeup of gas varies in most cases following breaking points, %:

H_2	55-60	C_mH_n	2-3
CH_4	22-28	N_2	2-4
CO	5-7	O_2	0-1
CO_2	2-3	H_2O	2-3

3. A liquid fuel. The partial makeup of the liquid fuels used for injection in blast furnaces, varies in following breaking points, %:

fuel	C	H	O+N	S
petroleum	84-85	12-14	0,5-1,7	0,03-4,3
mazut	86-88	10-12,5	0,6-1,0	0,4-0,7
coal-tar pitch	89-93	5-9	0,5-1,0	0,4-1,7

4. Solid fuel. Main fuel of the blast furnace is the coke loaded in turn with ore or a sinter. Good coke contains 80-86 % With, 0,4-0,7 % S, 2-6 % of a moisture, coke burn down in a devil at the expense of oxygen of a blow, as a result of his combustion the gases necessary for a melting of pig-iron and scoria are formed. If to take into account, that dry blast contains nitrogen the base response of burning $2C + O_2 = 2CO$ will match following to makeup of gas in a devil of the oven: 34,7 % CO, 65,3 % H_2. This gas is spread inside and hill up donating warmly charge to materials and interreacting with them as a reductant » [1].

Thus, the blast-furnace operation is carried out with the help of injection of hydrocarbons and the base gas consisting from CO and H_2 where quantity H_2 almost twice is more, than CO.

Deductions. Ground these practical effects{results} it is necessary to change the conventional judgement on a chemistry of processes of reception of pig-iron in which the base attention is given WITH, instead of $_{H2}$. If to prefer indirect reduction: $3Fe_2O_3 + H_2 = 2Fe_3O_4 + H_2O$, with which help 60-80 % of all iron with allowance for the gained experience about a heredity of properties in metals and alloys should be expected the successful solution of a problem on an opportunity of sharp pinch of all properties of domain pig-iron are recovered. Ground representations about the leading part of hydrogen during reception of domain pig-iron the most effective expedients of transmutation of gray iron in white and other provisions on transmutation of domain pig-iron into a high-quality material of a universal purpose [4, 5] designed.

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