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PURIFICATION OF PIG IRON

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The invention relates to a process for the purification of pig iron containing at least 0.1% of chromium.

It is known that iron ores with higher contents of chromium, for example 0.5%, cannot be directly smelted as only a small proportion of the chromium is taken up by the slag in the blast furnace, the main proportion going into the pig iron and remaining therein during the conversion to steel so that the properties of the steel are influenced in a frequently very undesirable manner. For example, even a comparatively small proportion of chromium reduces the weldability and also very seriously diminishes the case with which the steel can be cold worked, for example by cold rolling, cold drawing or deep drawing.

There are, however, large supplies of iron ore which contain a high proportion of iron of from 40–65%, together with appreciable quantities of chromium. These ores have, however, so far only been smelted in small quantities because there was no satisfactory method of removing the chromium in the slag in sufficient quantities.

The invention has for its object to enable high grade iron ores containing chromium to be smelted in such a way that the quantity of chromium remaining in the steel will no longer exercise a detrimental effect during its further treatment. This is achieved according to the invention by adding to the charge before, during or immediately after the purification of pig iron containing at least 0.1% of chromium, a quantity of an iron oxide, for example rolling mill scale, such that the chromium content in the metal is reduced to less than 0.06%. The process can be carried out in all furnaces which serve for the purification of pig iron.

It is known in the purification of pig iron in open hearth furnaces to add iron oxides, in particular iron ores, but it was not hitherto recognized that by the addition of sufficient quantities of iron oxide it is actually possible to remove in the slag the greater part of the chromium contained in the pig iron.

If insufficient quantities of iron oxide of the necessary purity are available, the process according to the invention, when the purifying operation is carried out in a converter, can be varied by purposely overblowing the charge, i. e. by supplying a quantity of air in excess of the theoretical quantity with consequent overheating of the charge and the production therein of considerable quantities of iron oxide. This iron oxide then has the same effect as added rolling mill scale, i. e. an appreciable quantity of the chromium content is removed in the slag. When using this method it is necessary to reckon with high degree of burning and a strong deoxidation is often required after the purification is ended. With this method good results can however be obtained, and particularly when manganese is added in an easily oxidizable form, for example as manganese dust. The manganese clearly operates as an oxygen transferrer because it accelerates the slagging of the chromium quite appreciably. Consequently it is convenient always to add manganese after oxygen or oxides in some form have been incorporated in the charge.

In the following table are set out the results of several experimental melts.

Charge Nr.	Pig iron kg.	Pig iron analysis						Steel analysis						Rolling mill scale in kg.	Manganese dust (67%) kg.
		Mn%	P%	S%	Si%	Cr%	Ni%	C%	Mn%	P%	S%	Cr%	Ni%		
7432	20,000	0,39	1,67	0,050	0,46	0,22	0,08	0,054	0,51	0,071	0,056	0,10	0,08	------	------
7436	19,900	0,38	1,65	0,051	0,45	0,22	0,08	0,052	0,53	0,058	0,053	0,10	0,07	------	------
7446	19,000	0,40	1,62	0,056	0,46	0,22	0,08	0,047	0,38	0,035	0,049	0,05	0,07	200	------
7449	24,100	0,40	1,62	0,065	0,48	0,22	0,09	0,045	0,39	0,060	0,065	0,04	0,08	400	------
7452	20,240	0,41	1,66	0,070	0,46	0,22	0,08	0,028	0,27	0,045	0,062	0,03	0,08	600	------
7457	21,950	0,37	1,67	0,068	0,41	0,22	0,08	0,047	0,36	0,050	0,065	0,03	0,08	800	------
7983	19,440	0,62	1,95	0,039	1,08	0,10	0,08	0,046	0,46	0,046	0,045	0,02	0,07	600	------
7982	20,200	0,62	1,94	0,037	1,08	0,11	0,08	0,06	0,47	0,064	0,037	0,04	0,07	------	100

Whilst for example in the case of melts 7432 and 7436 the chromium content of 0.22% in the pig iron sank to 0.01% in the finished steel, it was found possible with the same chromium content in the pig iron to reduce the chromium content in the steel,

In the case of melt 7446 by the addition of 200 kg of rolling mill scale to 0.05%,

In the case of melt 7449 by the addition of 400 kg of rolling mill scale to 0.04%,

In the case of melt 7452 by the addition of 600 kg of rolling mill scale to 0.03%, and

In the case of melt 7457 by the addition of 800 kg of rolling mill scale to 0.03%.

In the case of melt 7983, in which a pig iron containing 0.01% of chromium was used, it was possible by adding 600 kg of rolling mill scale, which was added half a minute after the decarbonization, to reduce the chromium content to 0.02%.

In the case of melt 7982, in which a pig iron containing 0.11% of chromium was used, an addition of 100 kg of finely ground ferro-manganese (76%) half a minute after decarbonization reduced the chromium content to 0.04%.

In the above the invention is set out as consisting primarily in the addition of iron oxide. Actually it should not be assumed that the slagging of the chromium is to be attributed to direct oxidation for it is known that chromium when once alloyed with iron in the small quantities here in question is very difficult to remove from the iron. The invention is probably based on the fact that the iron oxide so diminishes the solubility of the iron for chromium that the chromium goes very easily into the slag. This assumption is confirmed by the fact that the same effect can be obtained by employing manganese oxides in place of iron oxides, and the invention accordingly includes the use of oxides of manganese for this purpose.

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