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METHOD OF REFINING FERROCHROME

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This invention relates to a novel and improved method of refining ferro-chrome, and the novel features will be best understood from the following description.

According to present practice, ferro-chrome is produced by methods which result in the presence of an undesirable amount of carbon, and various expedients have been adopted to either avoid the presence of this carbon or remove it by refining. While these expedients have been successful, nevertheless they are expensive, and therefore, it is the object of this invention to devise a method of refining ferro-chrome which shall be relatively inexpensive and, at the same time, shall be effective in producing a refined low carbon product.

According to the invention, I take as the raw product a suitable ferro-chrome which may be made by any of the usual methods now in use. This ferro-chrome is then dissolved in hydrochloric acid to form chlorides. The chloride solution is then filtered in order to remove carbon and earthy and other impurities, after which it is evaporated and the residue collected. This residue of course comprises chlorides formed by the preceding operations, and I place this chloride material in a suitable tube, retort or other container, and there subject it to a temperature of approximately 1550° C. in the presence of hydrogen. By the expression "approximately 1550° C." I of course do not intend to limit myself to that exact temperature. The temperature may vary from approximately 1500° C. to approximately 1600° C. and therefore when I refer to and claim "approximately 1550° C." I intend to cover a range within the approximate limits mentioned above, and do not intend to limit myself to that exact temperature.

The hydrogen will unite with the chlorine in the chloride to form hydrochloric acid which may be carried off and condensed and used again in the operation, thus leaving as a residue a refined ferro-chrome of low carbon content. By maintaining proper conditions, a ferro-chrome with practically no carbon can be thus produced, the carbon being released from the ferro-chrome when the chloride is formed and no carbon being subsequently used.

The hydrogen may be produced by any suitable means, as by electrolytic cells. I have also discovered that ammonia gas is a suitable reducing agent, this gas being broken up when subjected to a temperature of 800° C. or more. Therefore, by introducing ammonia gas into the container in which the ferro-chrome is being heated to a temperature of approximately 1550° C., the ammonia will be broken down and the nascent hydrogen may thus be made available for reducing the chloride.

A further use which may be made of the invention, is to add desired quantities of chromium to steels, to make an alloy having a desired composition. This may be done by use of a high-frequency electric furnace which is kept partly full of molten metal to which the chromium is to be added. This molten metal or metal bath is maintained at a high temperature such as 1600° C. and the stirring action characteristic of this type of furnace is carried on rapidly. The furnace should be covered with a tight cover, through which hydrogen gas is admitted, and also with a sealed opening through which the chloride mixture may be introduced at will. There should also be a vent through which may pass the gaseous products resulting from the reactions taking place in the furnace.

Chlorides of ferro-chrome are then introduced into the furnace together with proper amounts of hydrogen, and the result will be a reduction of the chlorides by the hydrogen, and the refined ferro-chrome particles will be incorporated in the metal bath, the hydrochloric gas and any unused hydrogen passing out through the vent and being recovered for future use.

The high-frequency furnace is especially suitable for this work because with it there is no possibility of carbon contamination, and also because it is possible to construct furnaces with the closed cover and other overhead arrangements necessary for the work.

I claim:—

1. The method of refining ferro-chrome which comprises dissolving the ferro-chrome

in hydrochloric acid, filtering out impurities, evaporating the acid, and subjecting the residue to the action of hydrogen at a temperature of approximately 1550° C.

2. The method of refining ferro-chrome which comprises converting the ferro-chrome into a chloride and subjecting the chloride to the action of hydrogen at a temperature high enough to reduce the chloride.

3. The method of refining ferro-chrome which comprises forming a chloride of ferro-chrome, heating the chloride to a temperature of approximately 1550° C., and submitting the chloride at that temperature to the action of hydrogen.

4. The method of refining ferro-chrome which comprises forming a chloride of ferro-chrome, and reducing the chloride by heating it in the presence of ammonia to the temperature of approximately 1550° C.

5. The method which consists in forming a chloride of ferro-chrome, and reducing the chloride in the presence of hydrogen in a metal bath.

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