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FORMATION OF CHROMIUM-CONTAINING
LAYERS ON FERROUS SURFACESKarl Daeves and Gottfried Becker, Dusseldorf,
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4 Claims. (Cl. 148-14)

This invention relates to a process of producing a chromium containing surface layer on ferrous articles. According to a former proposal in our application Serial No. 219,920, filed July 18, 1938, small pieces of a ceramic material such as porcelain or sillimanite are charged with a chromium chloride compound, particularly chromous chloride, the articles to be treated being surrounded by this carrier material in a container which then will be closed and heated to temperatures of about 900 to 1000° C. for a period of time. Since the chromium chloride employed does not act immediately and freely upon the articles to be treated but is delivered from the carrier material charged as described above, the cementation of the surface of the ferrous articles proceeds much more uniformly and vigorously than usually.

The carrier may advantageously consist of porcelain or sillimanite, since these consist primarily of substances which are not attacked by chromium chloride, but also contain substances which are so attacked. The action of chromium chloride on such a carrier leads to the production of very fine pores and passages in which chromium chloride can be condensed and subsequently volatilized. Naturally it is also possible, and in some cases advantageous, to start with a material the pieces of which are already porous. A further and important advantage obtained by using porcelain or sillimanite is that they do not contain, or contain only in minute quantities substances, which form compounds with chromium chloride, such for example as alkali or alkaline earth silicates. Ceramic materials which contain considerable amounts of such substances should be avoided, since they render much of the chromium inoperative and thus render the process uneconomical.

The carrier material in form of small pieces is charged with the chromium chloride compound by allowing a gaseous chromium chloride to act upon it at temperatures of about 1000° C. for about 4 to 5 hours, said chromium chloride being produced by passing hydrochloric acid gas over ferrochromium or by vaporizing chromium chloride salt in presence of hydrogen. After being charged the carrier material may then be used as chromizing medium. In accordance with the proposal in the application Serial No. 219,920 the articles to be chromized are packed into this material and the whole is heated for 4 to 5 hours in a closed container at temperatures between 950 and 1000° C.

According to the present invention, the

chromizing process according to the application Serial No. 219,920 is improved and further developed by the addition of a certain amount of ferrochromium in form of small pieces to the carrier material charged with chromium chloride wherein the articles to be chromized are packed. Extensive experiments have shown the surprising result that by the admixture of ferrochromium to the ceramic carrier material the activity of this material will be substantially increased. By mixing pieces of ferrochromium with the chromium chloride charged carrier material sufficient chromium layers may be obtained even with a carrier material which is charged with the chromizing medium only in small amounts, so that it will be possible to reuse material from which the chromium chloride has been partly removed in a chromizing process according to application Serial No. 219,920.

The process according to the present invention may be performed in the following manner:

For instance, carrier material consisting of sillimanite or porcelain in pieces of 5 to 15 mm. is charged before starting the chromizing process with the chromium chloride by subjecting it to a chromium chloride gas at temperatures from 900 to 1100° C. The chromium chloride gas may be produced by passing hydrochloric acid gas over incandescent ferrochromium and the carrier material treated with the chromium chloride gas until the material ceases to suffer any considerable change of weight. We then make up a mixture of the chromium chloride charged carrier material and ferrochromium which has about the same size as the carrier material, 50 parts by weight of carrier material and 50 parts by weight of ferrochromium being introduced into a container and the articles to be chromized being packed therein. In order to prevent oxidation of the articles to be treated, any traces of air in the container will be driven out by a neutral gas or hydrogen, the container being then closed and heated to temperatures of 900 to 1100° C. until the cementation of the surface of the ferrous articles as desired has been accomplished. During the chromizing process no gas need be passed through the container; it is, however, preferable to compensate for the contraction of the reacting gas during the cooling period by an appropriate amount of a neutral gas or of hydrogen in order to prevent a vacuum in the container.

The size of the ceramic materials and ferrochromium pieces depends upon the dimensions of the articles to be treated. In any case, however, the carrier material and the ferrochromium

should have the form of pieces and not of powder or sand, the pieces being always of such a size that the articles to be treated are as far as possible uniformly surrounded by them. It has been found that the most recommendable size both of the ceramic carrier material and of the ferro-chromium is from 5 to 15 mm.

We claim:

1. A method of forming chromium-containing layers on ferrous metal articles, which comprises packing the article in pieces of ceramic carrier material selected from the group consisting of porcelain and sillimanite charged with chromium chloride and admixed with pieces of ferro-chromium, and heating the mass to a temperature in the neighborhood of 900° to 1100° C.

2. A method of forming chromium-containing layers on ferrous metal articles, which comprises packing the article in from 30 to 60 parts by weight of ceramic carrier material selected from the group consisting of porcelain and sillimanite in pieces charged with chromium chloride and from 70 to 40 parts by weight of ferro-chromium in pieces, and heating the mass to a temperature in the neighborhood of 900° to 1100° C.

3. A method of forming chromium-containing layers on ferrous metal articles, which comprises packing the article in from 30 to 60 parts by weight of ceramic carrier material selected from the group consisting of porcelain and sillimanite in pieces from 5 to 15 mm. in size charged with chromium chloride and admixed with from 70 to 40 parts by weight of ferro-chromium in pieces from 5 to 15 mm. in size, and heating the mass to a temperature in the neighborhood of 900° to 1100° C.

4. A method of forming chromium-containing layers on ferrous metal articles, which comprises charging pieces of ceramic carrier material selected from the group consisting of porcelain and sillimanite with chromium chloride, packing the ferrous metal article in the charged pieces of ceramic material admixed with pieces of ferro-chromium, and heating the mass to a temperature in the neighborhood of 900° to 1100° C.

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