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METHOD OF TREATING METALLIC MATERIALS

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The present invention relates to a method of treating metallic materials and especially chromium-containing steels for the purpose of modifying the materials, preferably, the surface thereof, to render them more suitable for subsequent technical operations such as, for example, non-cutting or plastic shaping and cladding operations. The method, according to the invention, is, for example, adapted to be used for metals of the iron group and copper which have been alloyed with one or more of the elements chromium, manganese, silicon, aluminum, molybdenum, vanadium, tungsten, titanium, niobium and like alloying elements capable of forming anions. Moreover, the method, according to the invention, is also applicable to alloys of metals of the iron group with one another and with one or more of the aforementioned alloying elements.

It is an object of the invention to provide an improved method for producing bright annealed products from bright or scale-coated material, preferably in the form of semi-finished products and, if desired, in further working up of the bright annealed products.

Bright annealing of metallic materials such as semi-finished products of all kinds is already known. It is also known to treat semi-finished products with or without a scale surface in a reducing gas for the purpose of producing a bright surface thereon. This method cannot, however, be carried out with chromium containing alloys without taking special additional measures. Furthermore, such a method is difficult to carry out with alloys containing the other anion forming elements mentioned above.

Frequently, the bright annealing of wires having a surface which is already bright has been carried out in vacuum. It has, however, been found that it was difficult to introduce such process in practice as such process is rather expensive in that it requires a relatively high vacuum and, consequently, relatively expensive equipment.

Mechanical descaling processes have also been employed to obtain bright surfaces. Such processes, however, have the disadvantage that the descaling can be carried out only to a certain degree, and the remaining scale residue causes an undesirable high tool wear.

In accordance with the invention, it was unexpectedly found that the aforementioned disadvantages can be avoided by treating either materials having a scale-coated surface or those already having a bright surface with fused salts, following such treatment with a treatment with water and then annealing such materials in a reducing atmosphere.

The fused salt baths employed for carrying out the process, according to the invention, are of known composition and have been previously employed for other purposes, for example, for treating metals prior to acid pickling to provide a bright surface. They essentially consist of a major portion of sodium and/or potassium hydroxide with additions of one or more oxidation and activation media such as nitrates, borates, peroxides, dichromates and manganates. The working temperatures of the baths employed, according to the invention, usually lie between 300 and 700° C. and, preferably, between 500 and 600° C. The time of the salt bath treatment varies between 10 and 60 minutes depending upon the composition of the metallic material treated.

It was unexpectedly found that metallic material treated with a fused salt bath followed by a water wash and annealing is so modified that it exhibits a bright surface and can easily be mechanically worked up further, for example, by a non-cutting shaping such as drawing. Also, metallic materials annealed, according to the invention, which are to be clad on one another can be welded in the same heat.

The method, according to the invention, distinguishes from the procedures previously generally employed in drawing and cladding in that no special pretreatment is necessary and, in particular, all pickling treatments are eliminated.

The process, according to the invention, is illustrated by the following examples.

Example 1

Rolled wire rod carrying mill scale and composed of a highly heat resistant alloy containing 80% of nickel and 20% of chromium was immersed for 15 minutes in a fused salt bath heated to a temperature of 550° C. The salt bath contained 75% by weight of caustic soda, 15% of sodium nitrate and 10% of sodium chromate. After removal from the salt bath, the wire rod was quenched in water and washed in water for two hours to remove any salt residues thereon. Thereupon it was annealed in an annealing pot for 3 hours at 950° C. in an atmosphere of dissociated ammonia. The wire was bright upon leaving the furnace.

Example 2

A bright hard steel band containing 18% of chromium, 10% of nickel, 2.5% of molybdenum and the remainder iron was to be soft-annealed without acquiring a scale deposit. It was immersed for 20 minutes in a salt bath heated to 550° C. containing 70% by weight of caustic soda, 20% of sodium nitrate and 10% of sodium dichromate. Thereupon it was quenched in water and washed with water for 2 hours. The resulting steel band which had acquired a dark brown to black deposit was then soft-annealed in a pot in an atmosphere of dissociated ammonia and the resulting annealed band was bright and required no further treatment before use for the purpose desired. As a comparative test, bands of the same type which had not been pretreated in a salt bath were annealed under the same conditions. They left the annealing furnace with a green oxide coating and were unusable.

Example 3

A bright soft wire having a diameter of 0.80 mm. was to be produced from a rolled wire rod 6.0 mm. in diameter composed of an alloy containing 20% of chromium, 30% of nickel and the remainder iron. The rolled wire rod supplied was treated for 30 minutes in a fused salt bath heated to 500° C. and containing 75% by weight of caustic soda, 10% of sodium dichromate and 15% of sodium nitrate. Thereupon the wire rod was quenched in water and annealed for 2 hours in an atmosphere of dissociated ammonia at the customary annealing temperature for the alloy. The wire, which was bright on leaving the furnace, was limed and drawn to a diameter of 2.20 mm. in 5 hours. The hard wire was again annealed in an atmosphere of dissociated ammonia, limed and drawn to a diameter of 0.80 in 7 more passes.

Example 4

Rolled wire rod of a diameter of 6 mm. and composed

of a resistance alloy containing 13.5% of manganese, 3% aluminum and the remainder substantially copper was to be drawn to a diameter of 2 mm. It was treated for 10 minutes at 450° C. in the same salt bath as in Example 3 and then quenched in water and annealed for 1 hour at 700° C. in an atmosphere of dissociated ammonia. After annealing, the wire rod was copper colored and was immersed in a hot borax solution and drawn to the desired dimension in dry soap. It was annealed in an atmosphere of dissociated ammonia, this time without previous treatment in the salt bath, whereupon the color of the original alloy was restored. The wear on the drawing die, which is usually very high with this alloy, was exceptionally slight.

Example 5

A steel plate of ordinary Siemens-Martin quality was to be clad on both sides with a stainless steel containing 18% of chromium and 8% of nickel. Both the steel plate and the covering sheets of the stainless steel had thick mill scale while in addition the steel plate was rusty. The steel plate and the stainless steel sheets were immersed, without pretreatment, for 30 minutes in a fused salt bath heated to 580° C. and containing 70% by weight of caustic soda, 15% of sodium nitrate, 10% of sodium dichromate and 5% of soda. After quenching in water and washing with water for 1 hour, the sheets which were brownish black in color, were packed in a known manner together with the steel plate in thin sheets and the whole assembly heated to 1100° C. in ordinary, that is, unpurified, hydrogen and then welded together in one heavy rolling operation. The bond obtained was very good and it was also maintained during further rolling.

I claim:

1. A method of treating a metallic material selected from the group consisting of alloys of metals of the iron group and alloys of copper with alloying elements capable of forming anions which comprises treating said metallic material in an oxidizing fused salt bath, the major portion of which is an alkali metal hydroxide, treating the thus obtained metallic material with water to remove any adhering salt and then annealing the metal material in a reducing atmosphere.

2. A method of treating a chromium containing steel article which comprises heating said article in an oxidizing fused salt bath, the major portion of which is an alkali metal hydroxide, treating the thus treated article with water to remove any adhering salt and then annealing the article in a reducing atmosphere.

3. A method of preparing metallic material selected from the group consisting of alloys of metals of the iron group and alloys of copper with alloying elements capable of forming anions for a plastic shaping operation which comprises treating said metallic material in an oxidizing fused salt bath, the major portion of which is an alkali metal hydroxide, treating the thus obtained metallic material with water to remove any adhering salt and then annealing the metal material in a reducing atmosphere.

4. A method of preparing a metallic material selected from the group consisting of alloys of metals of the iron group and alloys of copper with alloying elements capable of forming anions for a drawing operation which comprises treating said metallic material in an oxidizing fused salt bath, the major portion of which is an alkali metal hydroxide, treating the thus obtained metallic material with water to remove any adhering salt and then annealing the metal material in a reducing atmosphere.

5. The method which comprises treating metallic material selected from the group consisting of alloys of metals of the iron group and alloys of copper with alloying elements capable of forming anions in an oxidizing fused salt bath, the major portion of which is an alkali metal hydroxide, treating the thus obtained metallic material with water to remove any adhering salt, then annealing the thus pretreated metallic material in a reducing atmosphere and cladding such annealed metallic material with a metal in the same heat.

6. The method according to claim 5 in which the cladding metal has been pretreated in the same manner as the metallic material to be clad by treating such cladding metal in an oxidizing fused salt bath, the major portion of which is an alkali metal hydroxide, treating the thus obtained metallic material with water to remove any adhering salt and then annealing the thus pretreated material in a reducing atmosphere.

7. A process according to claim 1 in which said water treatment is a water quench followed by a water wash.

8. A process according to claim 1 in which the fused salt bath contains a minor proportion of at least one oxidizing agent.

9. A process according to claim 1 in which the temperature of the fused salt bath is between 300 and 700° C. and the time of treatment of the metallic article therein is between 10 and 60 minutes.

10. A process according to claim 1 in which hydrogen is employed for the reducing atmosphere.

11. A process according to claim 1 in which dissociated ammonia is employed for the reducing atmosphere.

12. A process according to claim 1 in which said metallic material contains at least one metal of the iron group as the base and in addition contains at least one element capable of forming anions.

13. A process according to claim 1 in which said metallic material is a copper base metal containing at least one element capable of forming anions.

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