SURFACE TREATMENT FOR METAL COATED OBJECTS

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The present invention relates to surface treatment for metal coated objects, and, more particularly, to a method of treating the surface of metal objects coated with another metal by the hot dip process so as to impart thereto excellent paint or lacquer adhesion as well as good appearance.

In general, metal objects coated with another metal are often coated with a liquid coating material, such as paint or lacquer in order to improve appearance as well as corrosion resistance. However, it is frequent that the liquid coating material is unable to adhere firmly to the surface of metal objects coated with another metal when it is directly applied to the metal surface without any surface treatment. With the above object in view, there have been proposed various processes of surface treatment, for example, phosphatizing, galvannealing, and abrading by means of mechanical wipers, etc., with a view to eliminating especially the so-called "spangle" on the coated metal surface.

Briefly, the invention comprises fusing the surface of a metal article which has been coated by another metal by the conventional hot dip process, and spraying gas thereon, and, alternatively, spraying simply either a gas flame or a hot gas thereon so as to effect fusion and gas spraying simultaneously. By this treatment, lacquer or paint adhesion to the treated metal surface increases considerably so that peeling off of coating films from the coated metal surface is prevented and a uniform smooth lacquer or painted coated metal surface free from spangles is obtained. It is believed that the above features have been brought about by the fact that the coated metal surface treated by the process of our invention has been covered with a large number of uniform microindentations into which lacquer or paint permeates thoroughly so as to increase adhesion thereof. In addition, the bonding strength between the coating metal layer and the surface of base metal to be coated is remarkably improved by this treatment.

The invention comprises applying gas at a perpendicular or oblique direction onto the coated metal surface in such manner that spangles on the metal surface are fused and innumerable uniform micro-indentations are produced thereon without formation of any spangle. Accordingly, as an appropriate process of treatment embodying our invention to meet the above requirement, a gas flame may be applied to the surface of coated metal objects at a perpendicular or oblique direction so that fusing of metal surface and application of gas flame may be performed simultaneously. It is to be understood that hot gas heated by electric resistance or other heating means may be sprayed onto the metal surface to be treated. A simplified flow diagram of the process is as follows:

- Hot dip coated metal article having spangles thereon
- Heating to temp. above melting temp. of coating metal
- Spraying gas flame onto surface of coating metal at temp. 600—1000° C. and press 800—8000 mm. Hg for 2—60 sec.

In reference to the time when the treatment of the invention should be carried out, it is preferable that this treatment is performed at the time immediately after emergence of the coated metal out of the molten coating metal bath when spangles are being formed on the surface thereof, but this treatment may be applied to any coated metal product which has been already coated with another metal long before. A period of time required for this treatment may vary according to the shape of a coated metal article and the thickness of coating metal layer, but, in general, a period of time between 2 seconds and one minute is sufficient for treating galvanized iron sheet and strip to obtain the desired effect.

If the heating time is too prolonged, an alloy layer between coating metal and base metal will develop, which results in disadvantage.

A temperature for this treatment may vary according to the kind of a coating metal, the shape of coated metal article, and the thickness of coating metal layer, but a temperature between the melting point of coating metal and 250° C. above thereof may be preferred. A much higher temperature than that may be preferred if a short time treatment is desired. The pressure of gas to be applied is preferably controlled according to the temperature of treatment and the roughness of coated metal surface in view.

In order to attain a uniform and thorough treatment in accordance with the invention, it is preferable that a flame and gas spray means consisting of a number of gas nozzles may be employed, in which gas pressure, volume of gas flow, and volume of air flow may be controlled as desired.

Our invention will be more readily understood by consideration of the following examples.

Example 1

On removing the coated ferrous strip from the molten coating metal bath by the Sendzimir process, the coating metal on the surface of ferrous strip cools and solidifies to form spangles on the surface thereof. Immediately thereafter, the surface of coated ferrous strip is treated with the flame of coke oven gas having the static pressure of 1300 mm. water column at a temperature of about 600° C. for a period of 5 seconds, which results in a zinc-coated ferrous strip free from spangles having a large number of very fine micro-indentations all over the surface thereof. Paint or lacquer adherence of the above treated zinc-coated ferrous product has been found to be excellent. Comparative test has been conducted on the paint or lacquer adherence of treated, non-treated, and phosphated treated zinc-coated ferrous product, respectively. Test has shown that paint adhesion of treated zinc-coated sheet corresponds almost to that of phosphate treated one, and paint adherence has increased by about 30—50% in the treated one greater than the non-treated.

In addition, the appearance of treated and painted zinc-coated sheet or strip is much smoother and more beautiful than the non-treated.

Example 2

Galvanized iron sheet produced by the conventional hot dip process which comprises subjecting the sheet to removing grease, pickling, flux treatment, dipping in the molten zinc bath, and then to conductor roll has been in the storage for a considerable period of time, and this galvanized iron sheet is treated with the cracked ammonia gas (its static pressure: 3000 mm. water column) at a temperature of 650° C. for a period of 10 seconds. By this treatment, paint or lacquer adhesion to the treated galvanized iron sheet has increased by 20—40%. In addition, the appearance of treated and painted galvanized
iron sheet is much smoother and more beautiful than the non-treated and painted one.

Example 3

An aluminum-coated steel sheet which has been in the storage for a considerable period of time is treated in accordance with the invention with a coke oven gas flame (its static pressure: 1300 mm. water column) at a temperature of 800° C. for a period of 5 seconds. By this treatment, paint or lacquer adhesion to the treated aluminum-coated steel sheet has improved by 20–30%.

It is to be understood that the above examples are given for purposes of illustration only, and are not to be considered as limiting the invention to any of the specific conditions or materials given therein.

We claim:

1. A method of treating the surface of a metal article hot dip coated with another metal, the surface of the coating metal having spangles thereon, comprising heating said metal article to a temperature above the melting point of said coating metal and spraying a gas flame on the surface of the coating metal at an angle thereto and over the entire surface of the coating metal at a temperature between 600° and 1000° C. at a pressure of from 1000 to 4000 mm. of water and for a period of from 2 to 60 seconds, whereby spangles on said coating metal surface are fused and innumerable micro-indentations are formed thereon and an improved appearance and paint adherence is obtained on said coating metal surface.

2. A method of treating the surface of a metal article hot dip coated with another metal, the surface of the coating metal having spangles thereon, comprising spraying a gas flame at a temperature above the melting point of said coating metal onto the surface of the coating metal at an angle thereto and over the entire surface of the coating metal at a pressure of from about 1000 to 4000 mm. of water for a period of from 2 to 60 seconds, whereby the simultaneous heating and gas flame impingement cause the spangles on the coating metal surface to be fused and innumerable micro-indentations are formed in the surface and an improved appearance and paint adherence is obtained on said coating metal surface.

3. A method of treating the surface of a steel strip coated with zinc by a hot dip process, comprising cooling the zinc coated steel strip after it emerges from the molten zinc bath until spangles form on the surface of the zinc coating, and immediately directing a coke oven gas flame against the thus cooled strip at a static pressure of from 1000 to 1500 mm. of water and a temperature of from 400 to 800° C. for a period of from 2 seconds to one minute, whereby the spangles on the zinc coating are fused and innumerable micro-indentations are formed in the zinc coating, and an improved appearance and paint adherence is obtained for the zinc coating.

4. A method of treating the surface of a ferrous sheet coated with zinc by a hot dip process, the zinc coating having spangles on the surface thereof, comprising directing a cracked ammonia gas flame against the sheet at a static pressure of from 2000 to 4000 mm. of water and at a temperature of from 500 to 750° C. for a period of from 2 seconds to one minute, whereby the spangles on the zinc coating are fused and innumerable micro-indentations are formed therein, and improved appearance and paint adherence are obtained for said zinc coating.

5. A method of treating the surface of a ferrous sheet coated with aluminum by a hot dip process, the aluminum coating having spangles on the surface thereof, comprising directing a coke oven gas flame against said sheet at a static pressure of from 1000 to 1500 mm. of water, at a temperature of from 500 to 1000° C., and for a period of from 2 seconds to one minute, whereby the spangles on the aluminum coating are fused and innumerable micro-indentations are formed therein, and improved appearance and paint adherence are obtained for said aluminum coating.

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