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METHOD OF AFTER-TREATMENT OF METAL PLATINGS

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U.S. Cl. 204—35 R 3 Claims

ABSTRACT OF THE DISCLOSURE

Metal articles plated with metals having a tendency of forming cracks in the deposited metals are subjected to a jet stream of solid particles such as glass beads to eliminate the cracks.

RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 698,416, filed Jan. 17, 1968 and now abandoned. It is also related to application Ser. No. 693,093, filed Dec. 26, 1967, now Pat. No. 3,470,073, issued Sept. 30, 1969.

This invention relates to an after-treatment of metal platings deposited on the surface of different metals.

Where the surface of metals is plated with different metals by a chemical or electrical process, fine cracks are often formed on the surface of the platings due to the difference in elastic limit or coefficient of expansion of two metals.

An object of this invention is to provide plated plates or sheets of excellent adhesiveness and corrosion resistance by driving off the bath composition remaining in the cracks by suitable means and then peening the plates by utilizing solid particles such as glass beads.

For example, when aluminum is plated upon a steel sheet by utilizing a molten bath maintained at a temperature of about 160° C., as described in said related application now 3,470,073, fine cracks are often formed around the periphery of aluminum crystal grains due to the difference in the expansion coefficient of aluminum and steel, the expansion coefficient being 22.5×10^{-6} for aluminum and 11.6×10^{-6} for steel. Even after removal of the plated sheet from the bath, the composition remains in said cracks to deteriorate the plating. Even when the plated article is thoroughly washed the remaining bath composition affects the corrosion proof property of aluminum. This invention contemplates a solution of this problem.

One prior approach for healing these cracks involves heating of the plated sheet to re-melt aluminum thus eliminating cracks. Alternatively, where the product is in the form of a plate, it is passed through a rolling mill to effect a slight reduction to close cracks by pressure. The former method, however, is not applicable where the material deteriorates by the heat of heat treatment or where the deposited metal alloys with the substrate metal, whereas the latter method is not applicable to products of irregular or complicated configuration.

Still another approach is to eliminate particles adhering to the steel surface such as rust by applying peening treatment. This method, however, is applicable only to big size particles and therefore the pressure of the nozzle in peening treatment is bigger.

According to this invention, glass beads are jetted with a very small nozzle pressure in order to eliminate fine cracks on the plated surface, utilizing the jet pressure

and malleability of aluminum, thus improving corrosion resistance of plated surface.

FIG. 1 shows results of visual observations and observations made with an electron microscope of a steel plate described in Example 1.

FIGS. 2*a–c* are photomicrographs of steel plates described in Example 1.

FIG. 3 shows corrosion results described in Example 2.

FIG. 4 shows relationships between the distance of a nozzle from an object which is treated and corrosion resistance, together with glass bead size.

The manner in which the present invention accomplishes the above described objects can be more fully apprehended from a consideration of the following descriptions and of the preferred examples.

The surface of aluminum plated steel after cooling is uneven and has fine cracks. In order to eliminate residual compounds from the electrolytic bath in the said cracks, aluminum plated steel is dipped in a tank filled with distilled water, rinsed by ultrasonic wave rinsing method and then dried. Glass beads having a predetermined diameter are jetted by a nozzle with a predetermined pressure. The distance between the plated surface and the nozzle is maintained constant. In the present invention, the diameter of the glass beads is set at 80 to 150μ, jet pressure of the pressure of the nozzle, 0.5 to 1.5 kg./cm.², and the distance between the plated surface and the nozzle is 100 mm., which may be varied according to the object to be treated.

Example 1

A steel plate which had been plated with aluminum in a molten bath was immediately placed in a vessel containing distilled water. Any material from the molten bath composition remaining in any cracks of the aluminum coating was then driven off thoroughly by applying an ultrasonic wave to the distilled water containing the aluminum-coated steel plate. The plate was then air dried.

A jet of fine glass beads having an average size of 80 microns was applied to the surface of the dried plate through a jet nozzle for 30 seconds under a pressure of 0.5 kg./cm.², the distance between the nozzle and the article being maintained at 100 mm. Soft aluminum was deformed to eliminate cracks thus improving the property of the aluminum plating.

The diameter of glass beads and nozzle pressure were then varied with the distance between the nozzle and the plated steel at 100 mm. and the time for jetting for 30 seconds.

Diameter of glass beads: 80μ, 150μ.
Nozzle pressure (kg./cm.²): 0.5, 0.075, 1.2, 1.25, 1.5, 1.75, 2.0, 5.0, 0.

Naked eye and electronic microscope observation of the plated surface after jetting was made, the result of which is shown in FIG. 1. Close examination of FIG. 1 shows the nozzle pressure of 0.5 to 1.5 kg./cm.² shows the best result. If the pressure is below 0.5 kg./cm.², the surface treatment is not satisfactorily conducted and if it exceeds 1.5 kg./cm.², the film may be damaged.

Test piece treated in the process where the diameter of glass beads was set at 150μ, nozzle pressure at 1.0 kg./cm.² is shown in FIGS. 2*a*, 2*b*, and 2*c*, as before the treatment, during the treatment and after the treatment, respectively, in electromiscroscopic photos (1:5000). While FIG. 2*a* shows cracks on the surface distinctly, no cracks are seen in FIG. 2*c*.

Example 2

Corrosion test of the treated test piece was conducted in Example 2. The salt water spray test (ASTM–B117–

49T) was used and test pieces were subjected to observation until red rust appeared. The result thereof is shown in FIG. 3. When the diameter of glass beads is 80μ, the corrosion resistance property of the surface film begins to improve from the point when the nozzle pressure is 0.5 kg./cm.², reaching its maximum at 1.0 kg./cm.², and becoming stationary at 1.7 kg./cm.². When the diameter of glass beads is 150μ, the corrosion resistance property of the film surface begins to improve as early as at the point of 0.3 kg./cm.² nozzle pressure, reaching its maximum at 0.7 kg./cm.², and becoming stationary at 1.5 kg./cm.².

From the foregoing, it is known that there is a correlation among the necessary factors for peening treatment; more in particular the smaller pressure obtains better results in the case of 150μ diameter glass beads.

Example 3

Study was made of the relation between the distance from the nozzle to the object to be treated and the corrosion resistance property. The glass beads of 80μ and 150μ were used and the jet pressure was 1.0 kg./cm.² for 30 seconds. The distance between the nozzle and the deposited metal was varied as 20, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220 and 240 mm. The same corrosion test as in Example 2 was applied. FIG. 4 shows its results, according to which the corrosion resistance property is at its maximum when the glass beads are 80μ in diameter and the distance between the nozzle and the deposited material is 40 mm. In excess of 40 mm. distance, the property gradually deteriorates. When the diameter is 150μ, the distance becomes maximum at 80 mm. From the foregoing, one learns the correlation among the diameter of glass beads, pressure of the nozzle, and the distance between the nozzle and the material. These three factors are to be varied in accordance with the variance of objects to be treated. The inventors have decided to adopt the glass beads having the diameter of 80 to 150μ and the pressure of the nozzle of 0.5 to 1.5 kg./cm.². The other factors are variable depending on the variance of objects to be treated.

As is clear from the foregoing, the present invention facilitates filling in the complex shapes of cavities on the plated surface by cleansing and drying of plated surface and by peening process and succeeds in obtaining beautiful plating surface without cracks. Such beautiful plated surface also has excellent corrosion resistance and adhesion properties.

The present invention has so far been described in respect of aluminum, but it is not limited only to aluminum. In such plating process as cadmium plating over the steels where the difference in expansion coefficient is great, the same type of treatment is possible and beautiful plating surface having excellent corrosion resistance is obtained. Even in the cases where cracks are seen between iron surface and plating because of expansion and contraction, this invention method is applicable if the plating metal has malleability.

We claim:

1. In the method of after-treatment of a plated metal which has a tendency of forming cracks in a metal deposit due to the difference in the expansion coefficient or in the elastic limit of the deposited metal and a base metal, the improvement which comprises: immersing in water an aluminum-plated steel formed by electrolytically plating the steel in a molten bath, subjecting the immersed aluminum-plated steel to an ultrasonic wave to thereby remove substantially all material left by the bath in the cracks of the aluminum plating, and then applying to the surface of the aluminum-plated steel a jet stream of glass beads in the size range of from about 80 to about 150 microns under a pressure of from about 0.5 to about 1.5 kg./cm.² to deform the aluminum plating and eliminate cracks therein.

2. The method of claim 1 wherein the plated metal is dried prior to application of the jet stream.

3. The method of claim 1 wherein the jet stream is applied to said plated aluminum or cadmium at a distance of from about 20 to about 200 mm.

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FIGURE 1

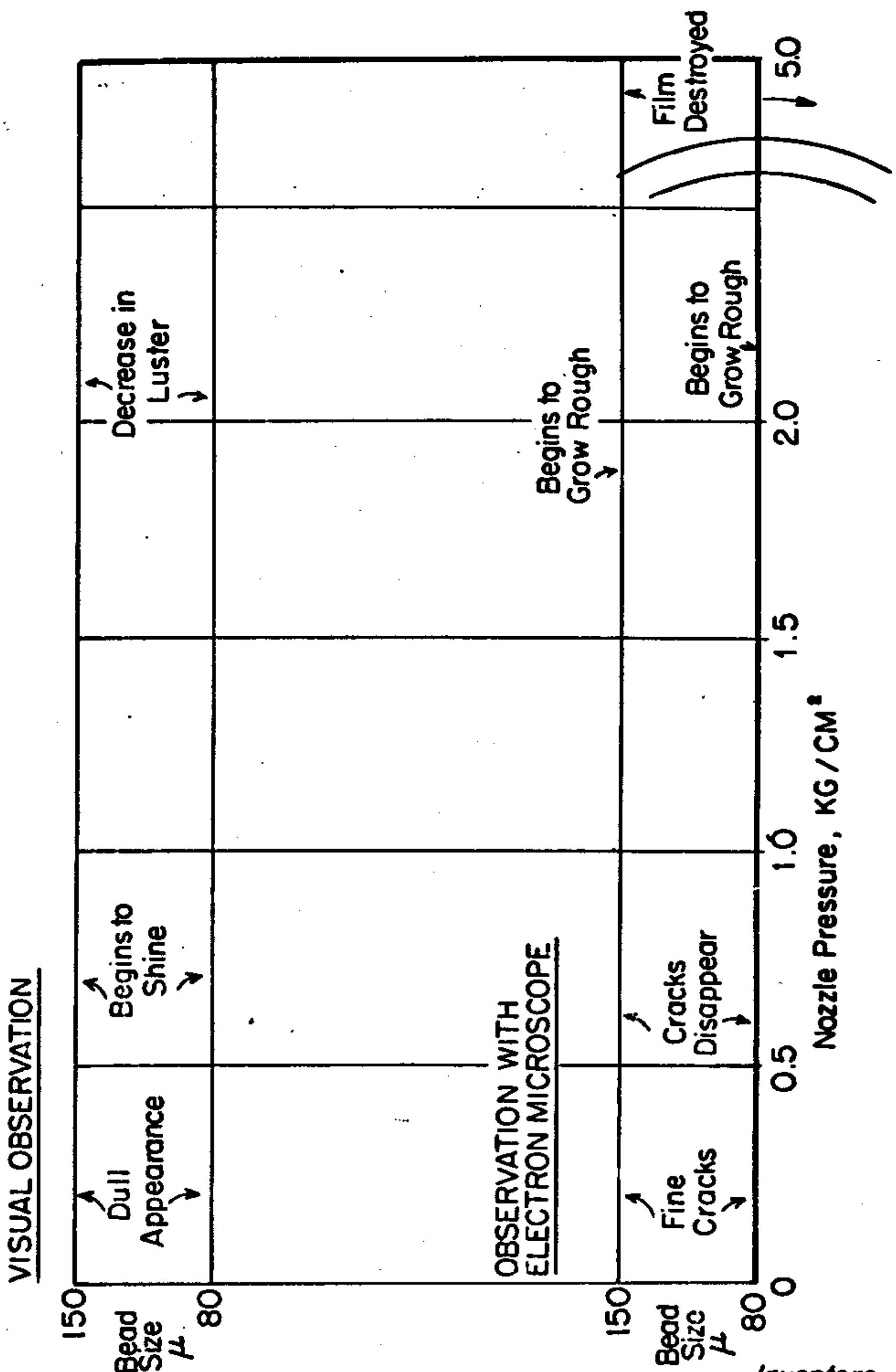

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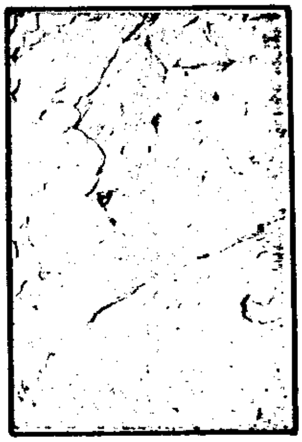
FIG. 2a

FIG. 2b



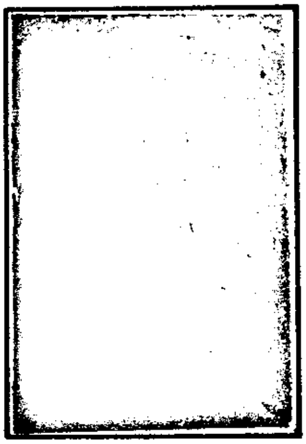


FIG. 2c

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FIGURE 3

Effect of Peening Upon Corrosion Resistance

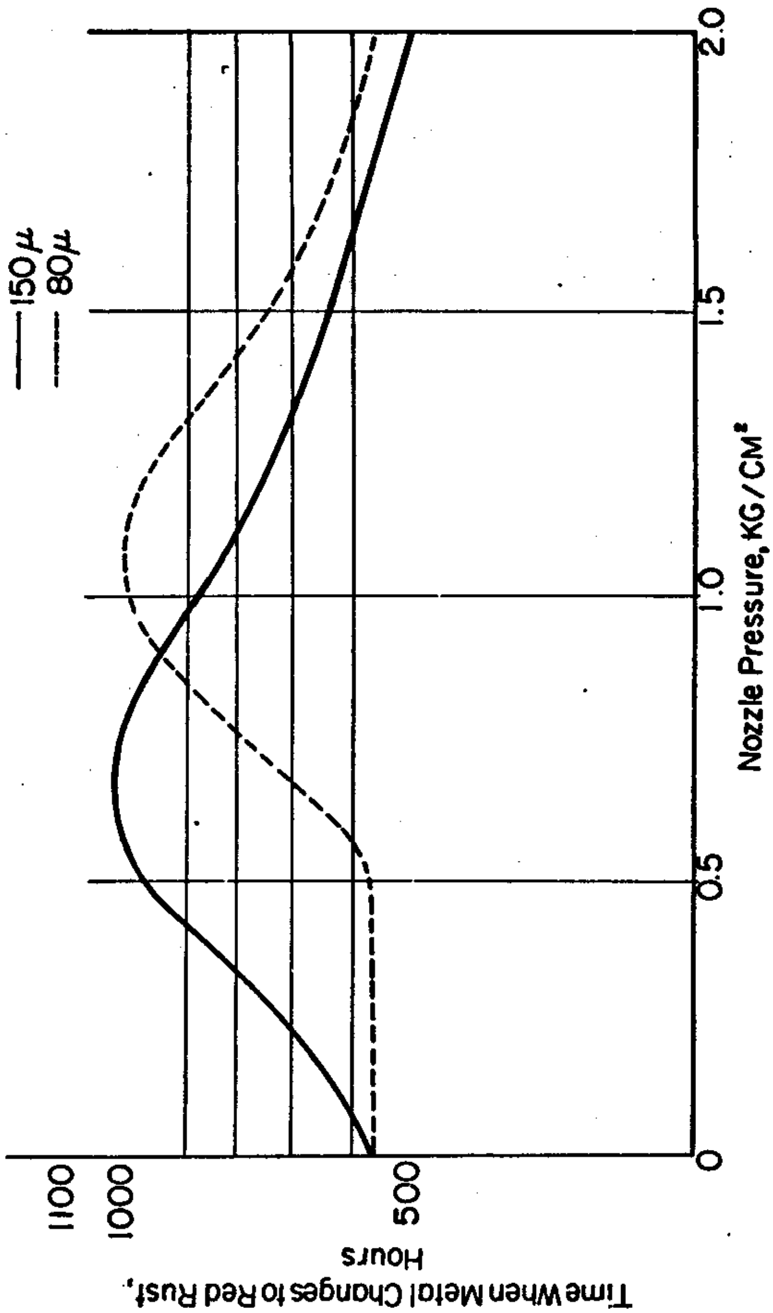

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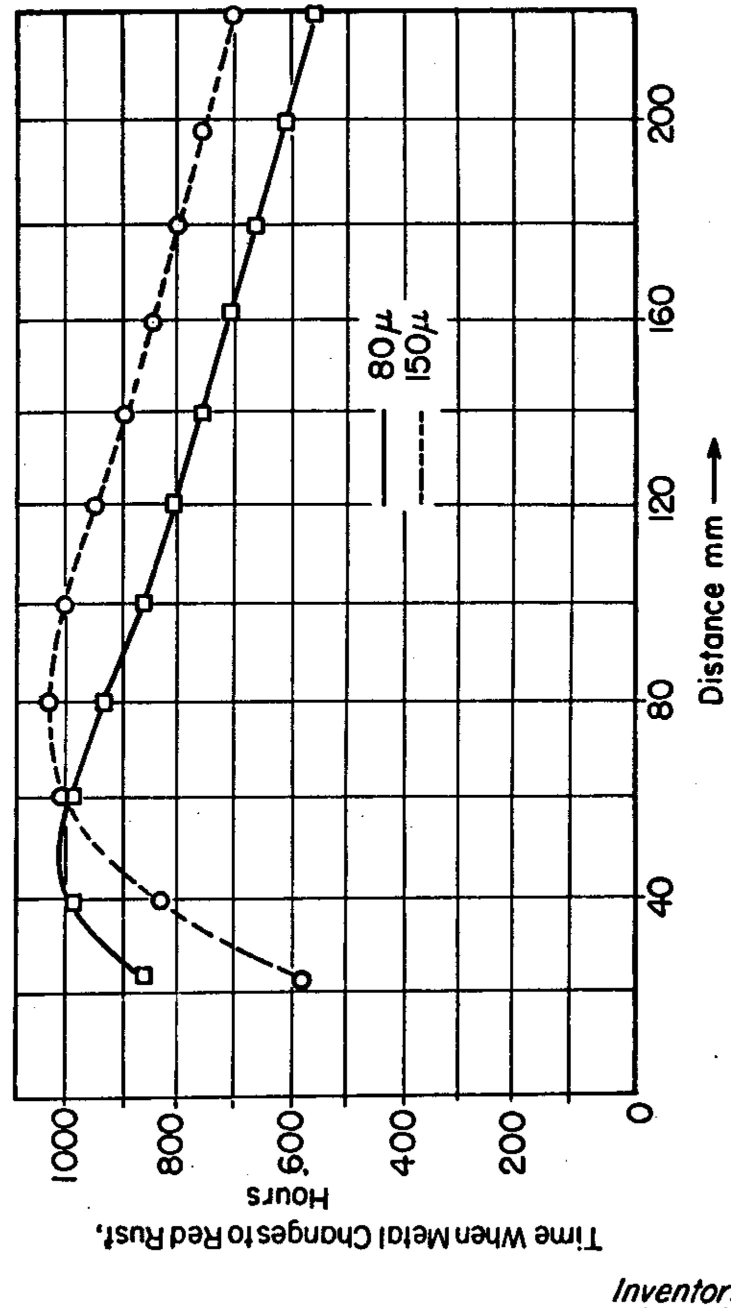
FIGURE 4

Effect of Distance from Nozzle to Sample upon Corrosion Resistance



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