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ZINC PLATING FERROUS ARTICLES

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This invention relates to the electrodeposition of zinc upon ferrous articles having a low hydrogen overvoltage and is more particularly directed to baths and processes wherein ferrous articles are treated with a hot aqueous solution of sodium cyanide prior to plating.

The electroplating of zinc on cast iron, malleable iron and on certain hot rolled steels has not been found commercially possible because no deposition of zinc can be obtained. As is well known, this is caused by the low overvoltage of hydrogen on the particular ferrous metal article. The difficulty of plating such articles is particularly marked when zinc is to be deposited from a cyanide-zinc plating solution.

Now I have found that cast iron, malleable iron, hot rolled steel, and other such ferrous metals upon which the hydrogen overvoltage is exceedingly low may satisfactorily be zinc plated if the articles prior to plating are subjected to the action of a hot aqueous solution of a soluble cyanide.

According to my invention the articles prior to treatment should be cleaned as is customary preparatory to plating. They should be free from grease, sand, oxides and other foreign material. The articles may be cleaned in customary manner as by the treatment with hydrofluoric acid, with alkaline cleaning solutions, with electrolytic cleaning methods, with vapor degreasing, or with a brief dip in an aqueous cyanide cleaning solution.

According to the processes of my invention, a suitably cleaned ferrous article is subjected to the action of a hot aqueous solution of sodium cyanide for as long a period as is required to make it amenable to zinc plating.

The aqueous cyanide solutions may be of almost any desired concentration, but it is preferred to have them fairly strong so that the time of treatment will not be too long. Generally it is satisfactory to employ a cyanide solution having from about two ounces per gallon of sodium cyanide up to solutions which are saturated with sodium cyanide. More specifically, I have found it commercially desirable to use solutions containing from about ten to about thirty ounces per gallon of sodium cyanide. Below about ten ounces per gallon the treating time becomes unduly long, and using more than thirty ounces per gallon of sodium cyanide is objectionable because the loss of cyanide from the treating bath is unduly great.

The aqueous solutions of sodium cyanide should be used at elevated temperatures. A

temperature not substantially lower than 65° C. should be used for satisfactory treatment, while more specifically I prefer to use a temperature between about 95 and 100° C.

The length of time of treatment depends upon the strength of the solution and upon its temperature, but in general it will be much longer than is ordinarily used in cleaning dips. The exact time can best be determined in a particular instance by treating the particular article to be plated with a specific solution under the particular conditions to be followed and determining by a few simple trials how long a treatment is required to make the articles amenable to zinc plating. From typical conditions investigated it has been found that ordinarily a treatment should be continued for at least about ten minutes. With a relatively dilute solution such as one containing about two ounces per gallon the treatment requires about thirty minutes, while with solutions having a concentration of thirty ounces per gallon of sodium cyanide the treatment can be completed in about five minutes. The treatment will rarely be found to require substantially less than five minutes, and this may ordinarily be regarded as the practical minimum time.

It is to be observed that the cyanide carried over from the cyanide pretreating bath of my invention into a cyanide-zinc plating bath will make up for the drag-out from the plating bath. It is preferable not to rinse the cyanide solution from the treated articles because such rinsing appears to diminish the efficacy of the treatment to a greater or lesser extent depending upon the thoroughness of the rinsing. It is customarily best to remove treated articles directly from the cyanide treating bath to the plating solution in the manner indicated.

I do not understand the theoretical reasons for the efficacy of my novel processes. It may be that the cyanide bath effects some modification in the electrical characteristics of the iron itself, or there may be some superficial surface modification of the chemical nature. It seems possible that the change of whatever character is rather temporary since subjecting treated articles to acids before they are plated apparently destroys the efficacy of the treatment.

My invention will be better understood by reference to the following illustrative examples:

Example 1

A number of cast iron pipe fittings were first cleaned and then were immersed in a sodium

cyanide solution. The sodium cyanide solution contained thirty ounces per gallon of sodium cyanide and was maintained at a temperature of 100° C. It was found that after fifteen minutes of treatment the cast iron articles were easily and very satisfactorily plated with zinc using a cyanide-zinc plating bath. It is observed that the articles could not be plated unless they were treated according to the processes of my invention. No deposit could be obtained on the articles from a cyanide-zinc plating bath.

Example 2

Cast iron articles were treated for thirty minutes in a sodium cyanide solution containing ten ounces per gallon of sodium cyanide. The treating bath was held at a temperature between about 95 and 100° C. After the thirty minutes of treatment, the articles were very satisfactorily plate in a cyanide-zinc plating bath, an adherent bright deposit easily being obtained. It is observed that when articles were treated for only fifteen minutes in the bath of this example, the deposit obtained was rather poor. When no treatment was used, it was not possible to obtain a zinc deposit.

While I have shown certain illustrative processes and compositions, it will be understood that without departing from the spirit of my invention one skilled in the art may readily devise numerous ways of treating ferrous articles on which the hydrogen overvoltage is low with aqueous sodium cyanide solutions to increase the hydrogen overvoltage. It will also be understood that instead of sodium cyanide one may use other soluble cyanides such as potassium or ammonium cyanide.

I claim:

1. In a process for zinc plating cleaned ferrous articles upon which the hydrogen overvoltage is so low as to interfere with the electrodeposition of zinc from a cyanide-zinc bath, the steps comprising treating such an article for not substantially less than five minutes with an aqueous solution containing from about ten to thirty ounces per gallon of sodium cyanide, the solution being maintained at a temperature not substantially lower than about 65° C. and the time of treatment being sufficient solely by reason of such treatment to raise the hydrogen overvoltage to a point such that satisfactory zinc deposition can be effected, then without removing the cyanide from the said article introducing it into a cyanide-zinc plating bath and electroplating thereon a deposit of zinc.

2. In a process for zinc plating cleaned ferrous articles upon which the hydrogen overvoltage is so low as to interfere with the electrodeposition of zinc from a cyanide-zinc bath, the steps comprising treating such an article for not substantially less than about five minutes in an aqueous

solution containing not less than about two ounces per gallon of a soluble cyanide the solution being maintained at a temperature not substantially lower than about 65° C. the time of treatment being sufficient solely by reason of such treatment to raise the hydrogen overvoltage to a point such that satisfactory zinc deposition can be effected, and then without treating the article to remove cyanide introducing it into a cyanide-zinc plating bath and there electrodepositing upon the article a coating of zinc.

3. In a process for zinc plating cleaned ferrous articles upon which the hydrogen overvoltage is so low as to interfere with the electrodeposition of zinc from a cyanide-zinc bath, the steps comprising treating such an article with an aqueous solution containing from about ten to thirty ounces per gallon of sodium cyanide, the solution being maintained at a temperature not substantially lower than about 65° C. and the time of treatment being sufficient solely by reason of such treatment to raise the hydrogen overvoltage to a point such that satisfactory zinc deposition can be effected, then without removing the cyanide from the said article introducing it into a cyanide-zinc plating bath and electroplating thereon a deposit of zinc.

4. In a process for zinc plating cleaned ferrous articles upon which the hydrogen overvoltage is so low as to interfere with the electrodeposition of zinc from a cyanide-zinc bath, the steps comprising treating such an article in an aqueous solution containing not less than about two ounces per gallon of a soluble cyanide the solution being maintained at a temperature not substantially lower than about 65° C. for as long a time as is required solely by reason of such treatment to raise the hydrogen overvoltage to a point such that satisfactory zinc deposition can be effected and then without treating the article to remove cyanide introducing it into a cyanide-zinc plating bath and there electrodepositing upon the article a coating of zinc.

5. In a process for zinc plating cleaned ferrous articles upon which the hydrogen overvoltage is so low as to interfere with the electrodeposition of zinc from a cyanide-zinc bath, the steps comprising treating such an article with an aqueous sodium cyanide solution to increase the hydrogen overvoltage to such a point that satisfactory zinc deposition can be effected, the strength of the cyanide solution being sufficient solely by reason of such treatment to permit the use of a moderate time of treatment the solution being maintained at a temperature not substantially lower than about 65° C., and then without treating the article to remove cyanide introducing it into a cyanide-zinc plating bath and there electrodepositing upon the article a coating of zinc.

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