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ELECTROLYTIC STRIPPING

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The invention relates to removing metal coatings from aluminum by electrolytic stripping.

The term "aluminum" as hereinafter used in the specification and claims is intended in a generic sense to include commercially pure aluminum and alloys which are predominantly, or contain a substantial amount of, aluminum.

There are numerous industrial or engineering applications which utilize chromium plated aluminum. The formability and light weight of an aluminum base object provided with a surface coating of chromium, which is hard, wear-resistant and possesses a low coefficient of friction, furnishes a most desirable combination and relationship of metals. With usage, however, the chromium surface coating may become worn in certain areas, whereupon it is desirable to remove the chromium deposit and replate the aluminum base object. There are certain applications where it is essential that the original dimensions of the underlying aluminum object be retained. Also, it is sometimes necessary to remove or strip improperly applied metal deposits or coatings from an aluminum object. Such deposits may be of nickel, copper, zinc or other metals, as well as chromium.

Prior art methods for stripping chromium and other metals from aluminum have been painstaking, costly and difficult to control, particularly from the standpoint of selectively removing the surface coating or overlying coatings without removing some metal from the aluminum base object. A primary object of the invention is to provide an improved process for stripping a metal coating or coatings from aluminum in a manner which does not result in the removal, or loss in weight, of aluminum.

Another object of the invention is to provide a process of stripping metal coatings from aluminum in a manner which eliminates the necessity for careful attention or close control of the process. The process is self-regulating in the sense that when the overlying metal coating or coatings are removed from the aluminum, the action of stripping ceases, leaving the aluminum object clean, without etching, dissolving or removing any of the aluminum.

Still a further object of the invention is to remove various metal coatings from aluminum in a rapid manner, while accomplishing the foregoing objects.

These, and other objects and advantages of the invention will be apparent from the following detailed description.

In accordance with a preferred embodiment of the invention, a stripping bath is provided which consists essentially of a dilute aqueous solution of sulphuric acid having a maximum concentration of approximately 15% by volume, or a specific gravity of 1.20. A solution as dilute as 2% by volume may be used. A 5% solution, or a solution having a specific gravity of 1.06, is preferred. A metal coated or plated aluminum object is made the anode in the dilute sulphuric acid stripping bath, the cathodes being of carbon or lead.

The metal coatings to be removed or stripped from the aluminum may be deposits of chromium, nickel, zinc or copper, or a composite coating comprising a plurality of layers of such metals. In fact, the process of my invention is suitable for removing from aluminum any metal which is soluble anodically in a dilute sulphuric acid solution. The coating metals may have been applied to the aluminum object in accordance with any of the procedures known in the art, whether by direct adherence of the metal deposit to the aluminum after suitable preliminary treatment, or by the use of an intermediate deposit, such as employed for example in the zinc immersion process of plating an aluminum object with chromium.

The described stripping bath is maintained at a temperature below approximately 100° F., a range of 65° to 100° F. being a suitable operating temperature. The metal coated aluminum object is made the anode in the bath and subjected to a high current density. A suitable current density is between approximately four (4) and one hundred and thirty (130) amperes per square inch, a current density range of between fifty (50) and seventy-five (75) amperes per square inch being preferred. A potential of between four (4) and ten (10) volts is used, it being understood that even higher voltages may be required where the object is irregular in shape and has recessed areas of substantial depth. It will be understood, of course, that with a metal coated aluminum object of given contour, the rate of removal of overlying metal is more rapid at the higher current densities. The very dilute sulphuric acid stripping solution is highly conductive.

With the described anodic stripping bath and conditions of temperature, current density and voltage, chromium, nickel, copper, zinc, or composite layers of such metal deposits are rapidly removed from the aluminum. As the metal overlying the aluminum is removed, the current decreases until a zero reading appears on the ammeter to indicate that stripping has been completed, and clean, bare aluminum has been reached. Even though the now stripped aluminum object is not immediately removed from the bath, my tests have shown that the aluminum object is not dissolved or loses any weight.

I am unable to explain with any degree of certainty why the action selectively ceases after the overlying metal or metals are removed from the aluminum, and does not remove aluminum. One possible explanation for the inertness of the underlying aluminum in my process, although aluminum ordinarily is soluble in dilute sulphuric acid, may be that a high oxygen over-voltage is formed at the surface of the aluminum object which acts in some manner to prevent the aluminum from going into solution. The high over-voltage seems to prevent any appreciable oxidation of the aluminum, or anodizing in depth; the voltage-amperage relationship used is outside the range which would permit the aluminum to be anodized to any extent. Analysis has indicated that there is no appreciable loss of aluminum to oxide as occurs when anodizing.

It is believed that the novel process of the present invention, as well as the advantages thereof will be apparent from the foregoing detailed description. Whereas prior to my invention, stripping metals from aluminum was a painstaking, costly and difficult to control procedure, metal coatings may now be removed from aluminum in a simple manner which leaves the aluminum clean and without loss in weight of aluminum. The process does not require close attention because when the underlying aluminum object is exposed, the current drops to zero and action ceases. The stripping solution is highly conductive, and the described conditions

under which the metal coated aluminum object is anodically treated are such that the overlying metal coating or coatings are very rapidly removed. It will also be apparent that while the invention has been described in a preferred form, changes may be made without departing from the spirit and scope of the invention, as sought to be defined in the following claims.

I claim:

1. A process of stripping a metal coating from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration less than approximately 15% by volume, said solution being maintained at a temperature below approximately 100° F., and passing current through said solution, the current density being in excess of approximately 4 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

2. A process of stripping a metal coating from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration of between approximately 2 to 15% by volume, said solution being maintained at a temperature below approximately 100° F., and passing current through said solution, the current density being in excess of approximately 4 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

3. A process of stripping a metal coating from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration less than approximately 15% by volume, said solution being maintained at a temperature below approximately 100° F., and passing current through said solution, the current density being approximately 4 to 130 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

4. A process of stripping a metal coating from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration of between approximately 2 to 15% by volume, said solution being maintained at a temperature below approximately 100° F., and passing current through said solution at a potential in excess of approximately 4 volts, the current density being in excess of approximately 4 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

5. A process of stripping a metal coating from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration of approximately 5% by volume, said solution being maintained at a temperature between approximately 65° and 100° F., passing current through said solution at a potential between approximately 4 and 10 volts, the current density being between approximately 50 and 75 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

6. A process of stripping a metal coating of the class consisting of chromium, nickel, copper and zinc from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration less than approximately 15% by volume, said solution being maintained at a temperature below approximately 100° F., and passing current through said solution, the current density being in excess of approximately 4 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

7. A process of stripping a metal coating of the class consisting of chromium, nickel, copper and zinc from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration of between approximately 2 to 15% by volume, said solution being maintained at a temperature below approximately 100° F., and passing current through said solution, the current density being in excess of approximately 4 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

8. A process of stripping a metal coating of the class consisting of chromium, nickel, copper and zinc from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration less than approximately 15% by volume, said solution being maintained at a temperature below approximately 100° F., and passing current through said solution, the current density being approximately 4 to 130 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

9. A process of stripping a metal coating of the class consisting of chromium, nickel, copper and zinc from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration of between approximately 2 to 15% by volume, said solution being maintained at a temperature below approximately 100° F., and passing current through said solution at a potential in excess of approximately 4 volts, the current density being in excess of approximately 4 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

10. A process of stripping a metal coating of the class consisting of chromium, nickel, copper and zinc from an underlying aluminum object, said process comprising making the coated aluminum object an anode in a dilute aqueous solution consisting essentially of sulphuric acid having a concentration of approximately 5% by volume, said solution being maintained at a temperature between approximately 65° and 100° F., and passing current through said solution at a potential of between approximately 4 and 10 volts, the current density being approximately 50 to 75 amperes per square inch, the complete removal of coating metal being indicated by a zero reading of current.

References Cited in the file of this patent

Journal of the Electrodepositors Tech. Soc., vol. 14, pp. 19–20, 1937–1938 and vol. 9, pp. 37–41, 1933–1934.

Metal Cleaning and Finishing, May 1937, pp. 380–381; July 1937, p. 580; September 1937, pp. 735–736.