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ALKALINE BATH REMOVAL OF SCALE FROM TITANUM WORKPIECES
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5 Claims

ABSTRACT OF THE DISCLOSURE

Titanium scale, generally comprising oxides and nitrates of titanium, may be removed from titanium workpieces by immersing the workpiece in an elevated temperature aqueous bath between about 180° F. and 200° F. containing per gallon from 3.1 to 5 pounds of the nitrate consists essentially of sodium gluconate, 8–30 weight percent, triethanolamine, 3–24 weight percent and sodium hydroxide, balance to 100 weight percent, and removing the workpiece from the bath following removal of scale from the workpiece.

BACKGROUND OF THE INVENTION

(1) Field of the invention

This invention has to do with the removal of scale, such as oxides, nitrates, sulfides and the like from the surfaces of titanium workpieces. Titanium scale and particularly oxides of titanium constitutes virtually the most refractory of all known materials. Titanium oxides have very high melting points and are resistant to almost all types of chemical attack. Many uses of titanium require the removal of the natural oxide coating or an oxide coating induced by metal treating processes such as heat treating, anodizing or oxides produced in the use of a part.

(2) Prior art

The heretofore accepted method for descaling titanium and removing the oxides from workpiece surfaces has included an alkaline precleaning step, sometimes followed by an alkaline conditioning step and a post treatment in a bath of nitric-hydrofluoric acid. Titanium oxide has been thought to be impervious to alkaline solutions and accordingly, efforts at improving the cleaning of titanium workpieces have been directed primarily at the development of more vigorous and more effective acids.

SUMMARY OF THE INVENTION

It has now been discovered that a highly alkaline solution such as an aqueous solution of sodium hydroxide is effective to remove scale from titanium workpieces where the scale removing bath contains certain amounts of both triethanolamine and sodium gluconate. The sodium gluconate may be formed in situ by the reaction of gluonic acid and sodium hydroxide.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In carrying out the present invention, a treating bath is prepared by dissolving in water from 3.1 to 5 pounds and preferably from 4 to 5 pounds of a mixture of sodium gluconate, triethanolamine and sodium hydroxide. The bath is heated to elevated temperature, generally about 175° F. up to just below the boiling point of the aqueous bath, and preferably between about 180–200° F.

The mixture dissolved in the aqueous bath consists essentially of sodium gluconate at 8 to 30 weight percent and preferably 13 to 23 weight percent, triethanolamine at 3 to 24 weight percent and preferably at 8 to 18 weight percent and the balance to 100 percent of sodium hydroxide.

The workpiece which may be degreased by conventional procedures in advance of scale removal, is immersed in the aqueous bath having the composition indicated above. Scale removal is initiated almost immediately with hydrogen evolution occurring visibly after a period of about one minute. Treatment in the bath is continued for a sufficient period to remove the scale from the workpiece surface. This may range from one minute to five minutes or more, up to about thirty minutes. Multiple immersions in successive or the same aqueous bath can be used where desired.

The titanium workpiece removed from the bath is cleaned of scale and is suitable for use subsequently in welding, bonding, plating or painting. Thus, the aqueous bath herein disclosed serves as a cleaner and a pickle for titanium.

Titanium alloys can be similarly treated as titanium workpieces. Alloys with such materials as columbium, hafnium, zirconium, and tantalum may be cleaned by the indicated procedures.

EXAMPLE 1

A titanium scale removal bath was prepared as follows:

A mixture of 18.5 percent sodium gluconate, 13.5 percent triethanolamine, and correspondingly 68 percent sodium hydroxide was mixed dry. An exothermic reaction took place with production of water. The mixture was dissolved at the rate of 3.1 to 5 pounds per gallon of bath in water. The water solution was heated to 200° F. Titanium workpieces having oxides and possibly nitride scale on their surfaces resulting from heat treating were immersed in the bath for periods ranging from ten minutes to thirty minutes. The workpieces were removed from the bath, when the scale thereon had been removed, rinsed and dried. The workpieces were noted to be clean enough without further processing for welding, bonding, plating or painting operations.

Control A

Example 1 was duplicated but omitting the sodium gluconate. There was no appreciable removal of scale in an hour and a half.

Control B

Example 1 was duplicated employing a mixture of sodium hydroxide and sodium gluconate. The resulting bath attacked the titanium oxide, but at a slow rate, requiring ninety minutes for removal. In addition, smut was produced on the titanium surface which was removable only with a dip in acid.

Control C

Example 1 was duplicated but omitting the sodium hydroxide. The resulting bath was ineffective for removing titanium scale from titanium workpieces.

Accordingly, combination of any two of the cleaning bath components is not effective as a cleaner due to slowness of attack on the substrate and oxide and uneconomically long processing times.

In the typical practice of the present invention, immersion times will range between one minute and ten to thirty minutes with longer or shorter periods, depending on scale conditions, temperature of the bath, and concentration of
the bath being useful. In this connection, a relatively more concentrated bath e.g. containing from 4 to 5 pounds of the above described mixture may be employed where particularly obdurate scale is to be removed.

I claim:

1. A method of descaling titanium comprising immersing a scaled titanium workpiece in a bath heated above 175° F., said bath being a solution of from 3.1 to 5 pounds per gallon of a mixture consisting essentially of
   Weight percent
   Sodium gluconate 8–30
   Triethanolamine 3–24
   Sodium hydroxide Balance to 100
   made up to a gallon with water, and removing the workpiece from the bath following scale removal.

2. Method according to claim 1 in which said bath has a temperature between about 180° F. and 200° F.

3. Method according to claim 1 in which the bath contains from 4 to 5 pounds of said mixture per gallon.

4. Method according to claim 1 in which said mixture contains
   Weight percent
   Sodium gluconate 13–23
   Triethanolamine 8–18
   Sodium hydroxide Balance to 100

5. Method according to claim 4 in which the workpiece is immersed in the bath for a period of 10 to 30 minutes.

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