United States Patent Office

3,514,407
Patented May 26, 1970

3,514,407

CHEMICAL POLISHING OF TITANIUM AND TITANIUM ALLOYS

Leo Missel, Endwell, N.Y., assignor to Lockheed Missiles & Space Company, a division of Lockheed Aircraft Corporation, Sunnyvale, Calif., a corporation of California

No Drawing. Filed Sept. 28, 1966, Ser. No. 583,125
Int. Cl. C23f 3/04, 1/00
U.S. Cl. 252—79.3 2 Claims

ABSTRACT OF THE DISCLOSURE

Solutions for polishing titanium and titanium alloy surfaces are disclosed. The solutions are mixtures of fluosilicic acid, hydrofluoric acid, nitric acid, acetic acid, and phosphoric acid. Polishing is accomplished by immersing objects made of titanium or titanium alloys in a solution containing the above acids at room temperature or elevated temperatures for periods up to 90 minutes.

This invention is a new and improved chemical solution for imparting bright and lustrous surfaces to articles made of titanium and alloys thereof.

In the past, metal surface polishing has been accomplished by dissolving thin layers of the metal chemically, or by abrading the surface, or by both.

The object of the present invention is to provide a chemical solution for imparting a visually bright and reflective surface to articles made of titanium and its alloys, with a minimum metal loss and minimum thermal emittance.

A further object is to provide a chemical solution for cleaning the surfaces of articles made of titanium and its alloys, preparatory to the firm bonding thereto of silicate paints, and the like.

Another object is to provide a metal surface polishing solution that requires the use of no electrical energy, does not require critical control of trained workers, and that provides results that are superior to comparable results attained by the use of processes that have been available to the trade previously.

The solutions that comprise the present invention are closely related in their compositions. In both solutions the titanium, or titanium alloy article, is immersed at ambient temperature or the temperature may be elevated to decrease the period of immersion.

Illustratively the solution for pure titanium articles is:

EXAMPLE 1

	Percent by volume
Fluosilicic acid (31%)	33
Hydrofluoric acid (48%)	8
Nitric acid (70%)	25
Acetic acid (99+%)	17
Phosphoric acid (85%)	17

Temperature (ambient).
Time (15–90 minutes).

Illustratively an alloy of the composition by weight of 90% titanium, 6% aluminum and 4% vanadium is immersed in the solution:

EXAMPLE 2

	Percent by volume
Fluosilicic acid (31%)	20
Hydrofluoric acid (48%)	15
Nitric acid (70%)	45
Acetic acid (99+%)	10
Phosphoric acid (85%)	10

Temperature (ambient).
Time (15–45 minutes).

The two solution examples are submitted as being illustrative examples that embody the successful practice of the present invention. Limited modifications in the above examples may be made without departing from the spirit and the scope of the present invention.

I claim:

1. A solution for chemically polishing pure titanium metal, said solution consisting of: 33% by volume fluosilicic acid (31%), 8% by volume hydrofluoric acid (48%), 25% by volume nitric acid (70%), 17% by volume acetic acid (99+%), and 17% by volume phosphoric acid (85%).

2. A solution for chemically polishing a titanium alloy wherein said titanium alloy consists essentially of the composition by weight of 90% titanium, 6% aluminum, and 4% vanadium; said solution consisting of: 20% by volume fluosilicic acid (31%), 15% by volume hydrofluoric acid (48%), 45% by volume nitric acid (70%), 10% by volume acetic acid (99+%), and 10% by volume phosphoric acid (85%).

References Cited

UNITED STATES PATENTS

3,202,612	8/1965	Nelson	252—79.2
3,085,917	4/1963	Netzler et al.	252—79.3 XR
3,007,780	11/1961	Beigay et al.	252—79.3 XR
2,559,445	7/1951	Lotz	252—136
2,711,364	6/1955	Beach	41—42
3,125,474	3/1964	Watkins et al.	156—18

LEON D. ROSDOL, Primary Examiner
D. L. ALBRECHT, Assistant Examiner

U.S. Cl. X.R.

134—41; 156—20; 252—79.4, 142