

UNITED STATES PATENT OFFICE

2,125,340

OXIDATION OF TITANOUS SALTS

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7 Claims. (Cl. 23—87)

The present invention relates to the oxidation of dissolved trivalent titanium salts by means of elemental oxygen and a catalyst, the latter being, particularly, copper. Titanous salt solutions such as titanous chloride or particularly titanous sulfate are, under certain conditions, relatively easy to oxidize by means of elemental oxygen or atmospheric air, for example, when the titanium content of such solutions is relatively very low and when the solutions are neutral or nearly neutral. If, however, the titanium solution is such as is produced under the usual conditions of manufacture the behavior is entirely different and the titanium in the titanous state is extremely difficult to oxidize by means of elemental oxygen or atmospheric air.

For example, in titanium oxide manufacture the solutions of titanium salt prior to the hydrolysis step contain from 150 grams to 275 grams of titanium in solution. From 99.5 per cent to 98.0 per cent of such titanium is in the titanous state with from 0.5 per cent to 2.0 per cent in the titanous state. Furthermore, such solutions contain relatively large quantities of free sulfuric acid, from 150 grams to 300 grams of H_2SO_4 per liter. It is under conditions such as these that the oxidation of trivalent titanium content of such solutions by means of elemental oxygen or atmospheric air is extremely difficult and too time consuming to be practical on a commercial scale.

I found, however, that if the solution contains small amounts of a copper salt, elemental oxygen will readily oxidize trivalent titanium compounds to tetravalent titanium. I found, for instance, that when atmospheric air is bubbled through strong acid solutions containing trivalent titanium no oxidation of the trivalent titanium takes place, particularly at temperatures below $55^\circ C$. If a copper salt, however is present in the solution air will readily oxidize the trivalent titanium to tetravalent titanium even at room temperature and as the temperature is raised the speed with which oxidation takes place increases tremendously. The amount of copper salt needed as a catalyst in this reaction, is very slight, and it is usually sufficient to suspend some copper oxide in the acid solution and very little copper is dissolved. For practical use of this reaction I prefer to carry it out at somewhat elevated temperature, as between 45 and $50^\circ C$. This type of reaction has many other practical applications in processes where small amounts of trivalent titanium present in a tetravalent

titanium salt solution are desired to be oxidized, such as disclosed in an application by Carlton E. Smith, Serial No. 58,257 filed at even date herewith.

I claim:

1. In an acid process of oxidizing trivalent titanium to tetravalent titanium the step of contacting a solution containing trivalent titanium with elemental oxygen in the presence of a small amount of an added copper compound as a catalyst.

2. In a process of oxidizing trivalent titanium to tetravalent titanium the step of bubbling air through an aqueous acid solution of trivalent titanium containing a small amount of an added copper compound as a catalyst.

3. In a process of oxidizing the trivalent titanium in an acid solution containing a major proportion of tetravalent titanium and a minor proportion of trivalent titanium, the steps of adding a small amount of a copper compound as a catalyst to said solution and contacting said solution with elemental oxygen.

4. A process for oxidizing trivalent titanium to tetravalent titanium, comprising contacting a trivalent titanium containing acid solution with a gaseous oxidizing medium from the group consisting of oxygen and air in the presence of a slight amount of an added copper salt as a catalyst and maintaining said solution during such contact at a temperature of substantially $45-50^\circ C$.

5. A process for oxidizing trivalent titanium to tetravalent titanium, comprising adding a slight amount of a copper compound to an acidic titanium salt solution prepared for hydrolysis, and thence subjecting the same to the oxidizing action of air.

6. A process for oxidizing trivalent titanium to tetravalent titanium, comprising introducing a gaseous oxidizing medium from the group consisting of oxygen and air into an acidic solution containing trivalent titanium and a small amount of a catalytic copper compound previously added to said solution.

7. A process for oxidizing trivalent titanium to tetravalent titanium, comprising introducing a gaseous oxidizing medium from the group consisting of oxygen and air into an acidic solution containing trivalent titanium and a small amount of a catalytic copper salt previously added to said solution.

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CERTIFICATE OF CORRECTION.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 6, claim 1, for the words "an acid process" read a process; line 8, same claim, for "a solution" read an acid solution; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of September, A. D. 1938.

Henry Van Arsdale

(Seal)

Acting Commissioner of Patents.