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# PREPARATION OF TITANIUM-MANGANESE ALLOYS

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1 Claim. (Cl. 204—71)

This invention relates to the preparation of titanium-manganese alloys. It relates especially to the preparation of highly pure alloys of titanium and manganese as determined, for example, by the electrode potential of such alloys against pure titanium by the procedure described in the copending application of W. W. Gullett, Serial No. 655,834, filed April 29, 1957, now abandoned.

I have found that when manganese metal is admixed with comminuted titanium to be refined in accordance with copending application of R. S. Dean and W. W. Gullett, Serial No. 601,705, filed Aug. 2, 1956, that the composition of the bath adjusts itself so that the cathode deposit has the same ratio of manganese to titanium as the anode.

This situation is shown in the following table:

PERCENT MANGANESE

| Anode | Cathode | Electrolyte |
|---|---|---|
| *Percent* | *Percent* | *Percent* |
| 2.0 | 1.95 | 0.06 |
| 3.0 | 2.9 | 0.11 |
| 4.0 | 4.0 | 0.12 |
| 6.0 | 6.1 | 0.17 |
| 8.0 | 7.9 | 0.24 |
| 12.0 | 11.9 | 0.38 |

*Example I*

In this example I take an electrolyte having the composition:

| | | |
|---|---|---|
| Soluble Ti as chloride | percent | 3.3 |
| Ave. valence Ti | | 2.30 |
| Mn as chloride | percent | 0.24 |
| Dissolved sodium | do | 1.1 |
| Balance NaCl | do | 95.36 |

I place this in a cylindrical cell heated to 850° C. and provided with an argon atmosphere. The cell has a centrally disposed iron cathode and an annularly disposed foraminous iron basket around the cathode. I place in the basket comminuted crude titanium and comminuted ferromanganese in such proportions that the ratio of maganese to titanium is 8%. I pass a direct current at a cathode current density of from 800 to 1000 amperes



per square foot and a small but indeterminate anode current. For every ampere hour passed, there is deposited adherent to the cathode, approximately .7 g. of highly pure 8% manganese-titanium alloy in the form of large crystal intergrowths. I measure the electrode potential of these crystal intergrowths against pure titanium and obtain a potential of 60 mv. which corresponds to less than .02% oxygen.

*Example II*

In this example I take an electrolyte having the composition:

| | | |
|---|---|---|
| Soluble Ti as chloride | percent | 3.0 |
| Ave. valence Ti | | 2.24 |
| Mn as chloride | percent | 0.12 |
| Dissolved sodium | do | 0.8 |
| Balance NaCl | do | 96.48 |

I proceed as in Example I, and place in the basket comminuted crude titanium and comminuted ferromanganese in such proportions that the ratio of manganese to titanium is 4%.

I pass a direct current at a cathode current density of from 800–1000 amperes per square foot and a small but indeterminate anode current density.

For every ampere hour passed there is deposited adherent to the cathode approximately .7 g. of highly pure 4% manganese-titanium alloy in the form of large crystal intergrowths.

I measure the electrode potential of these crystal intergrowths against pure titanium and obtain a potential of 56 mv. which corresponds to less than 0.02% oxygen.

What is claimed is:

The method of making a titanium-manganese alloy containing 2–12% manganese and less than .03% oxygen and substantially no other impurities which consists in mixing unalloyed impure titanium metal and a manganese-containing metal selected from the group consisting of metallic manganese and ferromanganese in the proportion of manganese and titanium desired in the alloy formed adherent to the cathode, making said mixture an anode, in an electrolytic cell having an electrolyte of sodium chloride having dissolved therein about 3% titanium chloride, average valence about 2.5, about 1% dissolved sodium and manganese as chloride from about .06% when the proportion of manganese in the anode material and deposited alloy is 2% and about .38% when this proportion is 12%, passing a direct current from said anode to an inert cathode, whereby to deposit crystal intergrowths of an alloy of titanium and manganese having the same proportions of these elements as in the anode material and containing less than .03% oxygen and substantially no other impurities.

**References Cited** in the file of this patent

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| 2,734,856 | Schultz et al. | Feb. 14, 1956 |
| 2,817,631 | Gullett | Dec. 24, 1957 |