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(54) **Titanium nitride dispersion strengthened bodies.**

(57) A porous body of titanium-containing alloy powder is heated first in a hydrogen-containing atmosphere to sinter the powder and to render it porous, and then in nitrogen/hydrogen to nitride the powder.

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Croydon Printing Company Ltd

Titanium Nitride Dispersion Strengthened Bodies

This invention relates to the production of titanium nitride dispersion strengthened bodies.

The strengthening of titanium containing alloys by gas-phase nitriding to produce a dispersion of titanium nitride is now an established procedure but the nitriding of thick sections remains a problem because the kinetics are so slow.

According to the present invention a method of production of a titanium nitride dispersion strengthened body involves the steps of producing a porous body from titanium containing alloy powder and then causing a flowing mixture of nitrogen and hydrogen to permeate the permeable matrix of powder particles so formed so as to effect nitriding of the titanium.

Preferably said porous body is produced by heating the powder in a hydrogen - containing atmosphere to achieve partial sintering, ie. sintering of the particles to such an extent that the body or matrix is permeable to the nitrogen/hydrogen gas flow and is sufficiently self-supporting to withstand the flow pressure. A suitable temperature for the partial sintering is in the range of 900-1250°C.

The initial porous bodies are preferably disc-shaped and may be formed by heating the powder in the container in which it is to be nitrided, or in a separate container of similar shape.

Another method of producing the porous sinter may be by causing the powder, in a semi-molten atomised form, to impinge and accumulate on a collecting plate. The bodies so formed will tend to be irregular in shape and may need machining to fit the nitriding container.

As previously mentioned the porous sinter must have sufficient strength not to disintegrate during the nitriding stage and sufficient interconnected porosity to allow access of the nitriding gas.

A suitable temperature for nitriding is in the range 1000 to 1150°C. After nitriding the body is preferably degassed in hydrogen to reduce the excess nitrogen in solid solution.

In one example of the invention, the nitrided alloy is used in the production of a tie bar of round section. In this case, the alloy powder may initially be produced as a plurality of disc-shaped green compacts which are then subjected to the aforesaid partial sintering and nitriding steps. Thereafter a quantity of the discs so formed may be inserted into an extrusion container and consolidated, by extrusion, into a round-section rod or bar.

In another example, a quantity of the porous bodies may be consolidated, eg. by a rolling technique, into sheet form. It will be understood that various other methods of consolidating quantities of the porous bodies into desired shapes may be employed.

If desired, after nitriding the porous bodies may once again be reduced to powder, as by comminuting, for use in conventional powder metallurgy forming techniques. It is thought that the nitrided powder will exhibit less susceptibility to oxidation at room temperatures than titanium oxide dispersion-strengthened powders which require special handling, eg. in inert atmospheres, to prevent oxidation at room temperatures.

The invention has particular application to the nitriding of titanium-containing austenitic and ferritic steel powders, especially 20% Cr/25% Ni/Ti powder. Thus, according to a further aspect of the invention there is provided a titanium-containing steel powder-formed body which has been produced in accordance with the method of the invention. The invention also extends to components consolidated from said bodies and to powder derived by comminution of said bodies.

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Claims

1. A method of production of a titanium nitride dispersion strengthened body characterised by the steps of producing a porous body from titanium containing alloy powder and then causing a flowing mixture of nitrogen and hydrogen to permeate the permeable matrix of powder particles so formed so as to effect nitriding of the titanium.

2. A method according to Claim 1, characterised in that the porous body is produced by heating the powder in a hydrogen-containing atmosphere to achieve partial sintering to the extent that the matrix is both permeable to the flow of nitrogen/hydrogen mixture and is sufficiently self-supporting to withstand the flow pressure.

3. A method according to Claim 2, characterised in that the partial sintering is carried out at a temperature within the range 900-1250°C.

4. A method according to any of the preceding Claims, characterised in that nitriding is carried out at a temperature within the range 1000-1150°C.

5. A method according to any of the preceding claims, characterised in that after the nitriding step the body is degassed in hydrogen to reduce excess nitrogen in the solid solution.

6. A method according to any of the preceding Claims, characterised by the further steps, to produce a

structural article of round section, of subjecting a plurality of said bodies which are of disc-shaped form to consolidation and extrusion.

7. A method according to any of Claims 1-5, characterised by the further step, to produce a structural article in sheet form, of subjecting a plurality of said bodies to consolidation by rolling out into sheet.

8. A method according to any of Claims 1-5, characterised by the further steps of comminuting a plurality of said bodies and forming structural articles to desired shapes by conventional powder metallurgy forming techniques.

9. Titanium nitride dispersion strengthened bodies characterised by having been produced by a method according to any of the preceding claims.

10. A titanium-containing steel powder-formed body characterised by having been produced by a method according to any of the preceding claims.

11. Structural components of or incorporating titanium nitride dispersion strengthened bodies according to Claims 9 or 10.

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EUROPEAN SEARCH REPORT

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Application number

EP 85 30 3822

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	US-A-2 933 386 (L.PESSEL) * Column 4, lines 17-29 *	1-11	C 22 C 1/10
Y	GB-A-1 434 729 (G.K.N.GROUP SERVICES) * Claims 1,6,10,15,18 *	1-11	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)
C 22 C B 22 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	09-07-1985	SCHRUERS H.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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