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DECISION
of 28 July 2003

Case Number: T 0294/00 - 3.2.2
Application Number: 93303930.7
Publication Number: 0571210
IPC: C22C 32/00
Language of the proceedings: EN

Title of invention:

Alloy having excellent corrosion resistance and abrasion resistance, method for producing the same and material for use in production of the same

Patentee:

TOSHIBA KIKAI KABUSHIKI KAISHA, et al

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 52(1), 56

Keyword:

"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



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Boards of Appeal

Chambres de recours

Case Number: T 0294/00 - 3.2.2

DECISION
of the Technical Board of Appeal 3.2.2
of 28 July 2003

Appellants:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 19 October 1999
refusing European application No. 93303930.7
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: W. D. Weiß
Members: S. S. Chowdhury
R. T. Menapace

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dated 19 October 1999 to refuse European patent application No. 93 303 930.7

The ground of refusal was that the claims did not relate to subject-matter involving an inventive step, having regard to document D1 (EP-A-0 460 211).

II. On 14 December 1999 the appellant (applicant) lodged an appeal against the decision and paid the prescribed fee on the following day. On 16 February 2000 a statement of grounds of appeal was filed.

III. The appellant requests that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:

- Claims 1 to 6 of the main request filed by fax dated 16 July 2003
- Description pages 1 to 26 filed by fax dated 16 July 2003
- Description page 4a filed by fax dated 21 July 2003
- Drawing sheets 1/14 to 14/14 of the application as originally filed.

Alternatively, it was requested that a patent be granted on the basis of claims of auxiliary requests 1, 2, or 3 filed with the grounds of appeal.

IV. The independent claims 1 and 5 of the main request reads as follows:

"1. A method for producing an alloy having excellent corrosion resistance and abrasion resistance, comprising the steps of: melting a powder mixture or VC-powder-containing wire comprising a matrix metal comprised of at least one member selected from an Fe-base alloy, a Co-base alloy and a Ni-base alloy and a VC powder having a particle diameter of 10 μm or less with a heat source having a high energy density and then cooling the resultant melt to homogeneously crystallize and/or precipitate VC having a particle diameter of 5 μm or less in said matrix metal phase.

5. An alloy having excellent corrosion resistance and abrasion resistance, comprising at least a matrix metal phase comprised of at least one member selected from an Fe-base alloy, a Co-base alloy and a Ni-base alloy and, present in said matrix metal phase, 10 to 65 %, in terms of the area, of a substantially homogeneously crystallized and/or precipitated VC particle phase having a particle diameter of about 1 μm or less."

Claims 2 to 4 are dependent on claim 1 and claim 6 is dependent on Claim 5.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. *Amendments*

The method of new claim 1 is essentially the same as the method of original claim 3. Claim 5 is identical with claim 1 of the application as originally filed save that the crystallized and/or precipitated VC particle phase is now said to have a particle diameter of about 1 μm or less instead of 5 μm or less, originally. The dimension "about 1 μm or less" is taken from the Examples. Although supported only by the Examples, these concern a variety of compositions, based on Co, Fe, and Ni base alloys, and having different proportions of VC, and all have a precipitated VC particle phase having a particle diameter of about 1 μm or less, so that this amendment is properly supported by the Examples of the application.

Dependent claims 2, 3, and 6 correspond to original claims 4, 5, and 2, respectively, and new claim 4 is supported by original claim 6. The description has been amended for consistency with the new claims. Therefore, the new claims and description meet the requirements of Article 123(2) EPC.

3. *Novelty*

The method of claim 1 of the application is novel over the disclosure of D1 because the method employs an initial VC-powder particle diameter of 10 μm as compared with the initial VC-powder particle diameter of 60 to 100 μm used in the method described in D1 (page 3, lines 51 and 52).

The alloy of claim 5 of the application is novel because the crystallized and/or precipitated VC particle phase has a particle diameter of about 1 μm or less, whereas the crystallized and/or precipitated VC particle phase in D1 has a particle diameter of about 3 μm or less (see Examples 1, 3, and 8).

4. *Inventive step*

4.1 D1 discloses a method for producing an alloy having excellent resistance to corrosion and abrasion, which comprises subjecting a powder mixture comprising a metallic powder of at least one alloy selected from Fe-base, Co-base and Ni-base alloys and a vanadium carbide powder to melting with a heat source having a high energy density. It is stated that the particle size of the VC powder is not necessarily critical, but in order to obtain good dispersion the particle size of the VC powder be between 60 to 100 μm (page 3, lines 51 and 52).

The applicant has discovered that although, in this prior art method, fine vanadium carbide particles having a diameter of 10 μm or less crystallize and precipitate, since some vanadium carbide particles remain unmelted, the melting step must be repeated many times to melt the remaining vanadium carbide particles. Further, observation under a microscope has revealed that part of the unmelted vanadium carbide is present in a massive form nevertheless, so that a fine vanadium carbide particle phase distributes heterogeneously, which makes it impossible to attain a satisfactory abrasion resistance, causes occurrence of cracking and

peeling due to local breaking, and reduces the service life ratio.

4.2 The technical problem to be solved is out as improving these properties but without compromising the corrosion resistance. In this respect the decision under appeal is wrong in stating that the use of a smaller particle size, as defined in claim 1, does not provide a solution to any technical problem.

4.3 The solution as claimed is to use a starting particle size of the VC powder of 10 μm or less in the claimed method so that the particles dissolve completely, even in a single melting step, and result in homogeneously crystallized and/or precipitated VC having a particle diameter of 5 μm or less in the matrix metal phase (claim 1), and an alloy in which the homogeneously crystallized and/or precipitated VC particle phase has a particle diameter of about 1 μm or less (claim 5).

Thus, the end product of the method of claim 1 contains a homogeneous dispersion of fine VC particles in contrast to the heterogeneous distribution of the VC particles in the product of D1 as observed under a microscope. In this respect the decision under appeal is, therefore, wrong in stating that the alloys produced by the method of D1 and that of claim 1 are indistinguishable from each other.

4.4 D1 states that in order to obtain good dispersion the particle size of the VC powder should be between 60 to 100 μm , and that a fine and uniform state of the dissolved VC is obtained by selecting appropriate cooling conditions (page 5, lines 15 to 20). In all the

Examples given to illustrate the invention of D1 the starting size of the VC powder is 70 μm but the final particle size varies from less than 3 μm (Examples 1, 3, 8) to 20 μm (Example 2). Therefore, D1 not only categorically states that the starting particle size should be between 60 to 100 μm , it also clearly does not suggest any direct relationship between the particle size of the starting material and the particle size of the precipitated VC phase in the matrix melt.

- 4.5 The applicant has plausibly argued that a technical prejudice had existed against a reduction in particle diameter from the range taught in D1. This concerns problems in handling the VC powder and the increase of specific surface area causing undesirable agglomeration (page 4, lines 47 to 49 of the A1 publication).

Contrary to this technical prejudice the application uses starting material having a particle size of 10 μm or less, which brings the advantages that it shortens the melting time, and promotes the homogeneous precipitation of a fine VC phase having a particle diameter of 5 μm or less. Moreover, the resulting product is an improvement over the products of D1 in relation to the peeling strength and abrasion resistance, as may be ascertained upon comparing Examples 1 and 4 of the application with Examples 1 and 4 of D1. The service life ratio is also improved, compare Examples 5 and 6 of the application with Examples 5 and 6 of D1. On the other hand corrosion resistance is not compromised, compare Table 2 of the application with Table 2 of D1.

In the decision under appeal the assertion that the person skilled in the art faced with the difficulty of melting and/or dissolving particles has two options, namely to increase heat input or decrease particle size, not only ignores the teaching of D1, but is also not supported by any independent evidence. The assertion might be valid if the claimed starting particle size were near to the range of 60 to 100 μm taught in D1, but the claimed upper limit of 10 μm for the starting particle size is a quantum jump away from the range of D1, for which reason the argument in the decision under appeal is not valid.

- 4.6 The Examples of D1 describe the phase of fine VC particles composed mainly of particles having a size smaller than 3 μm (Examples 1, 3, 8). The other Examples are concerned with VC particle sizes of about 20 μm (Example 2), less than 5 μm (Example 7), and smaller than about 10 μm (Example 9), but the document does not suggest that there is any advantage to be obtained in having particles any smaller than 3 μm . In fact, Figure 20 shows the results of the abrasion test and demonstrates that best results are not obtained for Example 8 in which the VC particle size is lowest. Examples 7 to 9 also present results of corrosion tests and show that the corrosion rate and VC particle size are inversely related so no advantage is obtained in this respect by decreasing the particle size any further than 3 μm . The claimed particle size of 1 μm is, therefore, not suggested by D1.
- 4.7 It is acknowledged in the decision under appeal that the alloy of claim 1 has better technical properties than the alloy of D1, for example with respect to

peeling strength, which is due to the small VC particle size. It is argued in the decision under appeal, however, that the improved peeling strength cannot be achieved over the whole range claimed in claim 1 since the application demonstrates the improved technical results over D1 only for precipitated VC particles of 1 μm or less.

The Board does not agree with this since there is no evidence for doubting that the advantages achieved by using such a small particle size would be apparent within the entire particle size range claimed, particularly since the range of 5 μm or less is not excessive and is clearly demarked from the prior art range of D1. Moreover, as set out above, the method of claim 1 involves an inventive step by virtue of the VC powder having a particle diameter of 10 μm or less in the starting material, so the method is allowable under Article 52(1) EPC irrespective of whether or not other features of the claim also involve an inventive step.

- 4.8 The Board has also read documents D2 to D5 cited during the examination procedure, but does not consider them to be relevant enough to warrant a detailed analysis here.
- 4.9 For the above reasons the method of claim 1 and the alloy of claim 5 both involve an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance to grant a patent on the basis of the following documents:
 - Claims 1 to 6 of the main request received by fax on 15 July 2003
 - Description pages 1 to 26 received by fax on 16 July 2003
 - Description page 4a received by fax on 21 July 2003
 - Drawing sheets 1/14 to 14/14 of the application as originally filed.

The Registrar:


V. Commare

The Chairman:


W. D. Weiß

