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(54) Method for making a blade and blade manufactured thereby

(57) The present invention provides a blade material and a manufacturing method thereof adapted to maintain high wear resistance, high hardness, and relatively small specific gravity by using light alloy having a high hardness. A method for making a blade and blade manufactured thereby according to the present invention comprises the steps of preparing a powder mixture having 10-90 weight % of a first matter and 10-90 weight % of a second matter out of a total of 100 weight %, wherein the first matter is Carbide Vanadium (VC) having seven or less specific gravity, and the second matter is Titanium (Ti) or Titanium (Ti) alloy powder having seven or less specific gravity. A molded material is then obtained by packing the powder mixture into a mold and then pressing it. Finally, the molded material is sintered at below 1500°C, wherein the molded and sintered material has a hardness equal to or larger than HRA60 and seven or less specific gravity.

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to blades of cooking knives or of various shapes including a circular one and, more particularly, to blade materials constituted by light alloy having a high hardness, and a manufacturing method thereof.

BACKGROUND OF THE INVENTION

[0002] In cooking knives, common knives, circular spin knives, and shavers with various shapes, blades (cutters) are generally processed first by punching a rolling steel plate. Next, the steel plate is subject to heat treatment and hardening in order to form the blade.

[0003] The first characteristic required from the conventional blade is a lasting cutting property. To achieve this characteristic, it has been carried out a method to increase the hardness of the blade material. However, there is a drawback in this method in that both the hardness and brittleness of Carbon steel increase during a quench process.

[0004] Furthermore, powder sintered blades made from Carbide Tungsten (WC) powder and Cobalt (Co) powder are heavy in specific gravity at a value between 10 to 16 depending on the compositions thereof, such that the powder sintered blades have been limited in usage.

SUMMARY OF THE INVENTION

[0005] Embodiments of the present invention provide a blade material and a manufacturing method thereof adapted to maintain high wear resistance, high hardness, and low specific gravity by using light alloy having a high hardness.

[0006] In one preferred embodiment of the present invention, a method for making a blade and blade manufactured thereby comprises the step of preparing a powder mixture having 10-90 weight % of a first matter and 10-90 weight % of a second matter out of a total of 100 weight %, wherein the first matter is Carbide Vanadium (VC) having a specific gravity of seven or less, and the second matter is Titanium (Ti) or Titanium (Ti) alloy powder having a specific gravity of seven or less. Then, a molded material is obtained by packing the powder mixture into a mold and then pressing it. Finally, the molded material is sintered at below 1500°C, wherein the molded and sintered material has a hardness greater than or equal to HRA60 and a specific gravity of seven or less.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] For fuller understanding of the nature and objects of the present invention, reference should be made to the following detailed description taken in conjunction with the accompanying drawings in which:

FIG 1 is a perspective view of a circular blade manufactured by a method of making a blade according to an embodiment of the present invention; and
FIG 2 is a cross-sectional view of the blade of FIG 1.

DETAILED DESCRIPTION OF THE INVENTION

[0008] The preferred embodiment of the present invention will now be described in detail with reference to the attached FIGS. 1 and 2.

[0009] Carbide Vanadium (VC) is used as a principle material for a blade in the embodiment of the present invention. The VC having a micro Vickers HV=2600 is higher in hardness than that of Carbide Tungsten (WC) conventional powder sintered blade material having micro Vickers HV=1780. A sintered body of VC-Titanium (Ti) or VC-Ti alloy is therefore preferably used as a main ingredient of the blade as it can have five to six specific gravity depending on compositions thereof. The sintered body is about a half or one third in specific gravity than that of WC-Co alloy having a high hardness having a value of 10-16.

[0010] When other conventional Carbon steel blades are quenched, the hardness is limited to HV-820·HRA 84 as the maximum value and approximately 8.5 in specific gravity. WC-Co alloy having a high hardness contains HV1800 (HRA92) as its maximum value and a specific gravity of around 15. The principal material of the present invention, VC, however, has a very high hardness HV2600 and light specific gravity ranging around 7, leading to properly embody a blade material of light and high hardness.

[0011] A manufacturing method of a circular blade according to the embodiment of FIGS. 1 and 2 will now be described.

[0012] VC powder having a specific gravity of seven or less is prepared at 10-90 weight % for a first matter. Ti or Ti alloy powder having a specific gravity of seven or less is prepared at 10-90 weight % for a second matter. Next, the first and second matters are blended to form a powder mixture having a 100 weight %.

[0013] VC is prepared at 10-90 weight % because if the VC content contains a weight % of 10 or less in the total powder mixture, the wear resistance or hardness thereof is lowered. If the VC content exceeds a weight % of 90 or higher, then the VC increases in brittleness as a result of the high hardness.

[0014] The powder mixture of VC (first matter) and Ti powder or Ti alloy powder (second matter) is packed in a mold of a desired shape, and undergoes a press formation under a pressing force of 10t per square centimeter (cm^2), thereby obtaining a molded material.

[0015] The molded material is taken out from the mold and sintered under a temperature of 1500°C or lower, preferably under 1300°C in a vacuum furnace for obtaining a circular blade as shown in FIG. 1.

[0016] With reference to FIGS. 1 and 2, a blade rotatably installed at a rotating axis of a machine as a rotating spin blade is formed with an insertion hole (1) into which the rotating axis is inserted. A plane part (3) is formed with a desired thickness by grinding the plane part. An outer periphery cutting edge portion (2) is formed by grinding the outer periphery of the plane part (3).

[0017] When VC is 10 weight % in relation to the entire weight of the powder mixture, the molded and sintered material obtains a hardness of HRA60.

[0018] In another embodiment of the present invention, silver powder as a third matter is added to the powder mixture of first and second matters for improving antibiosis and sanitation of the blade.

[0019] When a circular blade of a light alloy having a high hardness is used as a food cutting knife for meat, vegetables or the like, sanitation as well as a permanent cutting property are required. Therefore, silver is added to the light alloy having a high hardness according to the present invention for being used as a food cutting knife.

[0020] Once the blade is added with silver, it is possible to provide antibacterial property by silver ion to the blade. Thus, it can sustain a sanitary condition even if it is contaminated by blood or animal flesh since silver ion has an antibacterial property and self-purification.

[0021] In mixing Silver (Ag) powder to VC-Ti powder or VC-Ti alloy powder, if the Ag powder is 0.3 or less in weight %, the antibacterial function of Ag ion can be hardly expected. It is, however, expected to have a good antibacterial property if Ag ion is involved approximately 0.3 to 3.0 in weight % of the mixture powder. In addition, 3.0 or more weight % of the Ag ion does not affect obtaining a better antibiosis but only increases the manufacturing cost.

[0022] Meanwhile, when the powder mixture is packed, pressed and sintered in a mold, air holes are apt to be formed inside the structure of the sintered body. The amount of the air holes occurring generally varies according to pressure applied to the powder mixture during molding. In addition, the air holes inside the sintered body lower the actual density of the sintered body. In particular, when the air holes are formed at a cutting edge of the blade, a cutting capability of the blade is decreased.

[0023] In a third embodiment of the present invention, Co powder is added at 2-10 weight % to the powder mixture manufactured in the first embodiment or the second embodiment in order to overcome the aforementioned drawback. The powder mixture blended with the Co powder is packed into a mold of a desired shape and pressed and then sintered under a sintering temperature.

[0024] Once the Co powder is added to the powder mixture and the powder mixture is pressed and sintered, the Co powder easily melts and changes into a liquid form under the sintering temperature so as to obtain a high fluidity causing to flow into the air holes formed inside the sintered body thereby filling up the air holes. When the Co fills up the air holes, the air holes which lower the cutting capability of the blade are eliminated and the structure of the sintered body is increased in density as well.

[0025] If the amount of the Co is a weight % of 2 or less, the air holes formed inside the structure of the sintered body may be insufficiently packed. If the Co exceeds a weight % of 10 or higher, then the remaining Co after packing the air holes inside the sintered body is unevenly dispersed therein causing segregation.

[0026] The first matter VC is the principle material of the present invention for being light and having a high hardness. The second matter Ti serves as a binding material of the first matter particles for sintering the first matter particles as an overall mixture.

[0027] Thus, the Ti powder of the second matter can be substituted by Cobalt (Co) for being mixed, molded, and sintered with the VC powder, and obtaining a blade having light alloy having a high hardness.

[0028] Although the specific gravity of Co is relatively heavy at around 8.9, its ultimate specific gravity can be reduced to below 7 by adjusting the compound ratio with VC. Accordingly, VC-Co alloy having a high hardness can be effectively reduced in specific gravity like the first embodiment.

[0029] As apparent from the foregoing, there is an advantage in that a blade of light alloy can maintain its high hardness and low specific gravity.

[0030] There is another advantage in that the blade of the present invention has less weight and equal volume to the conventional blade, contributing to a reduction in the number of raw materials, cost, and facilitation in the manufacture thereof by miniaturizing the product.

[0031] There is still a further advantage in that the activating power required in operation of a machine is reduced as a result of the lightness in weight.

Claims

1. A method for making a blade and blade manufactured thereby, comprising the steps of:

   preparing a powder mixture having 10-90 weight % of a first matter and 10-90 weight % of a second matter out of a total of 100 weight %, wherein said first matter is Carbide Vanadium (VC) having seven or less specific gravity, and said second matter is Titanium (Ti) or Titanium (Ti) alloy powder having seven or less specific gravity;

   obtaining a molded material by packing said powder mixture into a mold and then pressing it; and

   sintering said molded material at below 1500°C, wherein said molded and sintered material has a hardness of greater than or equal to HRA60 and seven or less specific gravity.

2. The method for making a blade as defined in claim 1, wherein silver powder is further added at 0.3-3 weight % to said powder mixture.

3. The method for making a blade as defined in claim 1 or 2, further comprising the step of adding Cobalt powder at 2-10 weight % to said powder mixture.

4. A blade manufactured by the method for making a blade described in claims 1 to 3.

FIG.1

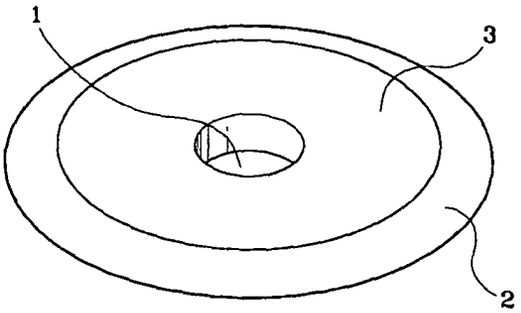
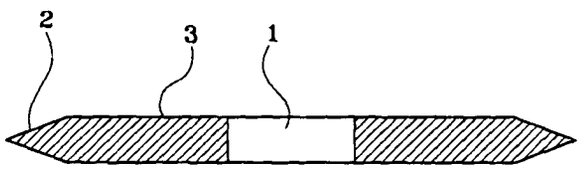


FIG.2



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EUROPEAN SEARCH REPORT

Application Number
EP 04 29 0527

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.7)
X	US 3 737 290 A (FREHN F) 5 June 1973 (1973-06-05)	1,4	C22C29/06
A	* the whole document *	2	
A	DE 197 20 706 A (EBARA CORP) 20 November 1997 (1997-11-20) * abstract *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 08, 6 October 2000 (2000-10-06) & JP 2000 127047 A (CHUKYO KENMA KK; OKAHATA TOKAI KK; NINAGAWA MACHI), 9 May 2000 (2000-05-09) * abstract *	2	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

C22C

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	26 May 2004	Alvazzi Delfrate, M

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
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1, 2 and claim 4 when depending on one of those claims

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LACK OF UNITY OF INVENTION SHEET B

Application Number
EP 04 29 0527

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1,2 and claim 4 when depending on one of those claims

   A blade comprising 0.3-3 wt% Ag and method of making it

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2. claim: 3 and claim 4 when depending on claim 3

   A blade comprising 2-10 wt% of Co and method of making it .

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 29 0527

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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26-05-2004

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82