(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 687 744 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
21.08.1996 Bulletin 1996/34

(43) Date of publication A2:
20.12.1995 Bulletin 1995/51

(21) Application number: **95107670.2**

(22) Date of filing: **18.05.1995**

(51) Int. Cl.[6]: **C22C 29/02**, C22C 29/04, C22C 29/08, C22C 29/16

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **19.05.1994 JP 105584/94**
15.02.1995 JP 49290/95

(71) Applicant: **SUMITOMO ELECTRIC INDUSTRIES, LTD.**
Osaka-shi, Osaka 541 (JP)

(72) Inventors:
- **Tsuda, Keiichi,**
  c/o Itami Works of Sumitomo Elec.
  Itami-shi, Hyogo (JP)
- **Isobe, Kazutaka,**
  c/o Itami Works of Sumitomo Elec.
  Itami-shi, Hyogo (JP)
- **Ikegaya, Akihiko,**
  c/o Itami Works of Sumitomo
  Itami-shi, Hyogo (JP)
- **Kitagawa, Nobuyuki,**
  c/o Itami Works of Sumitomo
  Itami-shi, Hyogo (JP)

(74) Representative: **Kirschner, Klaus Dieter, Dipl.-Phys.**
Patentanwälte
Herrmann-Trentepohl, Kirschner,
Grosse, Bockhorni & Partner
Forstenrieder Allee 59
D-81476 München (DE)

(54) Nitrogen-containing sintered hard alloy

(57) A nitrogen-containing sintered hard alloy includes at least 75 percent by weight and not more than 95 percent by weight of a hard phase containing Ti, a group 6A metal and WC in a prescribed composition, and at least 5 percent by weight and not more than 25 percent by weight of a binder phase containing Ni, Co and unavoidable impurities, and contains at least 5 percent by weight and not more than 60 percent by weight of Ti in terms of a carbide or the like, and at least 30 percent by weight and not more than 70 percent by weight of a metal belonging to the group 6A of the periodic table in terms of a carbide, while the atomic ratio of nitrogen/(carbon + nitrogen) in the hard phase is at least 0.2 and less than 0.5, and the nitrogen-containing sintered hard alloy is provided with a soft layer containing a binder phase metal and WC in its outermost surface, and has a layer which is hardly provided with the hard phase containing WC in a portion immediately under the soft layer in a thickness of at least 3 μm and not more than 30 μm. According to this composition, it is possible to provide a nitrogen-containing sintered hard alloy which can be employed as a cutting tool having high reliability with no surface coating also in working under conditions bringing a strong thermal shock.

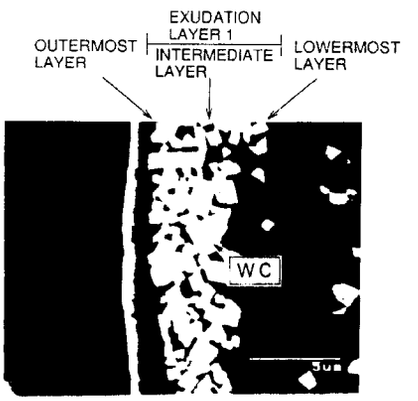

FIG. 1
SEM PHOTOGRAPH

EP 0 687 744 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 10 7670

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.6)
P,X	EP-A-0 603 143 (SANDVIK AB) 22 June 1994 * Fig.2; Claims 1-3; Page 2, line 58 - Page 3, line 10; Page 3, lines 19-27 * ---	1-6	C22C29/02 C22C29/04 C22C29/08 C22C29/16
X	EP-A-0 246 211 (SANTRADE LTD) 19 November 1987 * Page 2, lines 7-14; Page 2, line 36 - page 3, line 25; Page 5, lines 21-26; Figure * ---	1-6	
X A	US-A-4 277 283 (TOBIOKA MASAAKI ET AL) 7 July 1981 * Claims 1-3; Example * ---	1-6 7-12	
X	TRANSACTIONS OF THE JAPAN INSTITUTE OF METALS, vol. 22, no. 11, 1981, pages 758-764, XP002004622 SUZUKI H., HAYASHI K, AND TANIGUCHI Y.: "The beta-free layer formed near the surface of vacuum-sintered WC-beta-Co alloys containing nitrogen" * Abstract; Figure 5 * ---	1-3	TECHNICAL FIELDS SEARCHED (Int.Cl.6) C22C
X A	US-A-4 830 930 (TANIGUCHI YASURO ET AL) 16 May 1989 * Claims 1-3 * ---	1-6 7-12	
A,D	EP-A-0 499 223 (TOSHIBA TUNGALOY CO LTD) 19 August 1992 * Page 2, lines 33-38 * ---	1-12	
A	US-A-5 106 674 (OKADA YOSHIKAZU ET AL) 21 April 1992 * Col.2, lines 20-55 * ---	1-12	
	-/--		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	3 June 1996	Bjoerk, P

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)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 10 7670

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.6)
P,X	EP-A-0 635 580 (SUMITOMO ELECTRIC INDUSTRIES) 25 January 1995 * Page 5, lines 26-36; Page 6, lines 16-22; Claim 1 *	1-6	
A	EP-A-0 515 340 (SANDVIK AB) 25 November 1992 * Fig.2; Claims 1-5; Page 2, lines 22-27 and 37-39; Page 3, lines 13-18 *	7-12	
A	EP-A-0 368 336 (MITSUBISHI METAL CORP) 16 May 1990 * Claims 1-4; Col.1, lines 6-10 and 36-44 *	7-12	
A	US-A-4 778 521 (IYORI YUSUKE ET AL) 18 October 1988 * Claim 1; Table 1; Col.2, lines 14-24 *	7-12	
A	US-A-4 548 786 (YOHE WARREN C) 22 October 1985 * Examples I,II; Col.3, lines 34-53 *	7-12	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	US-A-4 610 931 (NEMETH BELA J ET AL) 9 September 1986 * Figure 3 *	7-12	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	3 June 1996	Bjoerk, P

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)

European Patent Office

CLAIMS INCURRING FEES

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

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

☐ Only part of the claims fees 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 claims:

☐ 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 requirement of unity of invention and relates to several inventions or groups of inventions,
namely:

1. Claims 1-6 relate to a $(TiW_xM_y)(CuN1-u)$, WC and binder phase sintered alloy with a depletion of hard phase in a portion immediately under a soft layer in a thickness of 3 to 30 μm
2. Claims 7-12 relate to a WC, carbide/nitride/carbonitride of groups 4A,5A,6A and binder phase sintered alloy with a particular three-fold exudation layer with varying WC-content, this exudation layer not fulfilling the requirements of claims 1-6

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

☐ 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 respects of which search fees have been paid,

namely claims:

☐ None of the further search fees has 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: