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**Datasheet for the decision
of 3 May 2007**

Case Number: T 0825/04 - 3.3.05

Application Number: 95402407.1

Publication Number: 0709353

IPC: C04B 35/5831

Language of the proceedings: EN

Title of invention:

Hard composite material for tools

Patentee:

SUMITOMO ELECTRIC INDUSTRIES, LIMITED

Opponent:

Mitsubishi Materials Corporation

Headword:

-

Relevant legal provisions:

EPC Art. 123(2), 56

Keyword:

"Added subject-matter (yes)"

"Inventive step (no)"

Decisions cited:

-

Catchword:

-



Case Number: T 0825/04 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 3 May 2007

Respondent:
(Opponent)

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Decision under appeal:

**Interlocutory decision of the Opposition
Division of the European Patent Office posted
26 April 2004 concerning maintenance of
European patent No. 0709353 in amended form.**

Composition of the Board:

Chairman: M. Eberhard
Members: H. Engl
S. Hoffmann

Summary of Facts and Submissions

- I. European patent EP 0 709 353 B1 was maintained in amended form by a decision of the opposition division posted on 26 April 2004, on the basis of the third auxiliary request filed during oral proceedings.
- II. The following documents were *inter alia* relied upon during the opposition procedure:
- D1: JP A 1 096 083; and
 - D2: English translation thereof
 - D11: Y. YAMADA *et al.*, Transactions of the Japan Soc. of Mechanical Engineers C, 1994-9, 60, 557, pages 14 - 18; and
 - D12: English translation thereof
 - D13: Front page of library copy of D11
 - D14: JP A 5 069 205; and
 - D15: English translation thereof
 - D16: JP A 61 230 803; and
 - D17: English translation thereof
- III. The main request and the first auxiliary request, in particular claims 7 thereof, were rejected by the opposition division under Art. 83 EPC because it was not sufficiently disclosed in the patent how transverse rupture strengths as defined in said claim 7 could be achieved. Claim 1 of the second auxiliary request lacked an inventive step because the improvement in wear resistance was not achievable over the whole range claimed. In particular, an improvement could be acknowledged only for hard layers of $Ti_xAl_{1-x}N$ wherein x was in the narrower range of $0.3 \leq x \leq 0.5$. However, the claims in accordance with the third auxiliary

request were found to meet the requirement of inventive step. Starting from D11/D12 as the closest prior art, the skilled person would be led away by the teaching of document D14/D15 from using a cubic boron nitride (cBN) sintered body as a base material.

IV. The patentee (henceforth: the appellant) lodged an appeal against this decision by letter dated 2 July 2004. The statement of the grounds of appeal was filed under cover of a letter dated 6 September 2004 and was accompanied with four new sets of claims as a main and three auxiliary requests. New test results including two graphs (Graph 1 and 2) and micrographs were also filed.

Auxiliary request 3 was later withdrawn (letter of 20 October 2004).

In the statement of grounds of appeal, the appellant identified D1/D2 as the most relevant prior art. Starting from said document, it saw the technical problem in the provision of a hard composite material which provides for a long tool life in conjunction with the machining of hardened steels. It was argued that the claimed invention provides cutting tools having both a superior wear resistance and a superior chipping resistance, compared with D1/D2, in the machining of hardened steels.

V. In an annex to the summons for oral proceedings, the board raised the question of whether it was obvious to the skilled person, confronted with the problem stated above, to replace the hard heat-resisting TiN film known from D1/D2 by a TiAlN film as disclosed in

document D11/D12. The board further raised the question whether the values of x , namely 0.1 and 0.7 in claim 1 of the first auxiliary request, met the requirements of Article 123(2) EPC.

VI. In reply to the summons to oral proceedings the appellant submitted 5 sets of amended claims as a main and four auxiliary requests, on 3 April 2007.

The main request differs from the claims in accordance with the main request pending before the opposition division during oral proceedings only in that claim 7 has been deleted.

Claim 1 thereof reads as follows:

"1. Hard composite material for cutting tools for hardened steels comprising a substrate of CBN sintered body containing more than 20% by volume of cubic boron nitride (CBN), characterized in that said substrate has at least one layer of hard heat-resisting film consisting mainly of Ti, Al and at least one element selected from a group comprising C, N and O on a portion or portions of said substrate where cutting takes place, and in that said sintered body is selected from following three types of CBN sintered bodies (1) to (3)

(1) CBN sintered body obtained by sintering at high-pressure 30 to 90% by volume of cubic boron nitride (CBN) powder and a binder powder of balance comprising at least one member selected from a group comprising nitride, carbide, boride and oxide of IVa, Va and VIa elements and their solid solutions and aluminum and/or aluminum compound, and inevitable impurities;

(2) CBN sintered body obtained by high-pressure sintering of 40 to 95% by volume of cubic boron nitride (CBN) powder and a binder powder of balance comprising 1 to 50% by weight of TiN, at least one member selected from a group comprising Co, Ni and WC, aluminum and/or aluminum compound and inevitable impurities; and
(3) CBN sintered body obtained by high-pressure sintering of more than 90% by volume of cubic boron nitride (CBN) powder and a binder powder of balance comprising boride of Ia or IIa elements, TiN and inevitable impurities,
wherein said hard heat-resisting film has a crystal structure of a cubic system, and wherein said hard heat-resisting film has a thickness of 0.5 to 15 μm ."

Claim 1 of the first auxiliary request differs from claim 1 in accordance with the main request in that the passage

"wherein said hard heat-resisting film has a crystal structure of a cubic system, and wherein said hard heat-resisting film has a thickness of 0.5 to 15 μm ."

is replaced by the passage

"wherein said hard heat-resisting film has a thickness of 0.5 to 15 μm , and an atomic ratio "x" of Ti/(Ti + Al) in said layer of hard heat-resisting film is $0.1 < x < 0.7$."

Claim 1 of the second auxiliary request differs from claim 1 of the preceding request in that the above passage is modified to read:

"wherein said hard heat-resisting film has a crystal structure of a cubic system, and wherein said hard heat-resisting film has a thickness of 0.5 to 15 μm , and an atomic ratio "x" of $\text{Ti}/(\text{Ti} + \text{Al})$ in said layer of hard heat-resisting film is $0.3 < x < 0.7$."

VII. Oral proceedings took place on 3 May 2007 in the absence of the respondent (opponent) who had informed the board with letter of 22 March 2007 that they will not attend the oral proceedings and that they will not submit requests.

During the oral proceedings, the appellant modified the claims of the third and fourth auxiliary requests filed with letter of 3 April 2007.

Claim 1 of this third auxiliary request differs from claim 1 of the main request in that subparagraphs (1) and (2) thereof now read:

- "(1) CBN sintered body obtained by sintering at high-pressure 30 to 90% by volume of cubic boron nitride (CBN) powder and a binder powder of balance comprising at least one member selected from a group comprising nitride, carbide, boride and oxide of **Titanium** and their solid solutions and aluminum and/or aluminum compound, and inevitable impurities;
- (2) CBN sintered body obtained by high-pressure sintering of 40 to 95% by volume of cubic boron nitride (CBN) powder and a binder powder of balance comprising 1 to 50% by weight of TiN , at least one member selected from a group comprising

Co and Ni, aluminum and/or aluminum compound and inevitable impurities, and"

Claim 1 of the fourth auxiliary request differs from claim 1 of the main request in that subparagraphs (1) and (2) thereof now read:

- "(1) CBN sintered body obtained by sintering at high-pressure 30 to 90% by volume of cubic boron nitride (CBN) powder and a binder powder of balance comprising [] nitride of **Titanium** [] and aluminum and/or aluminum compound, and inevitable impurities;
- (2) CBN sintered body obtained by high-pressure sintering of 40 to 95% by volume of cubic boron nitride (CBN) powder and a binder powder of balance comprising 1 to 50% by weight of TiN, at least one member selected from a group comprising **Co and Ni** [], aluminum and/or aluminum compound and inevitable impurities, and"

(amended passages shown in **bold** print; omissions shown as []).

VIII. The appellant's arguments may be summarized as follows:

The appellant regarded D1/D2 as the most relevant prior art. Starting from said document, the technical problem consisted in providing a hard composite material having a long tool life in conjunction with the machining of hardened steels. It was argued that the claimed invention provided cutting tools having both a superior wear resistance and a superior chipping resistance, compared with D1/D2, in the machining of hardened

steels. Contrary to what was held in the interlocutory decision of the opposition division, the desired technical effect of improved flank wear could be obtained by all compounds of the hard layer defined in the whole range as claimed (see Graph 1 annexed to the grounds of appeal). Similarly, improved chipping performance occurred over the whole range of TiAlN compositions used for the hard resisting film coated on the cBN sintered substrate. Data shown in Graph 2 proved that TiAlN films having an atomic ratio of $x = 0.1, 0.3, 0.5, 0.6, 0.7$ and 0.85 exhibited very low chipping compared with prior art TiN films and uncoated tools.

These improvements could not be derived from the prior art. In particular, document D12 disclosed that the chipping resistance is improved by modifying the form of the cutting tool, while the improved oxidation resistance is caused by the application of a (Ti,Al)N film. The skilled person would be motivated to modify the shape of the tool in accordance with the teaching of D12, rather than to replace the TiN film of D1 by the (Ti,Al)N layer of D12 since D1 explicitly teaches to maintain the combination of a cubic boron nitride sintered body with a TiN layer. D12 related to coated cutting tools based on a specific ultra-fine grain carbide substrate. It could be inferred from the reported hardness of HRA 91.5 that this material is tungsten carbide (WC). Said material exhibited a hardness of typically below 2000 HV and of approximately 1800 HV when shaped with a binder (usually Co). Therefore, it differed considerably in hardness from the cBN sintered body used as a base material in accordance with the invention, whose

hardness is 3,500 - 4,300 HV. D12 thus suggested using a film (TiAlN) having a hardness higher than the hardness of the substrate (WC), opposite to what was taught in D1 and in the opposed patent. The skilled person would therefore not consider applying TiAlN films on a very hard substrate such as a cBN sintered body. It was believed that the film hardness should be higher than the hardness of the base, and this prejudice was confirmed by document D17.

The adhesive properties of TiAlN films on a cBN sintered substrate were also not known. It was generally impossible to predict the performance of a new combination of base material and hard heat-resisting film. Experimental evidence filed as "Evaluation 2" in the affidavit submitted during the opposition procedure showed for instance that TiAlN films improved the flank wear when deposited on alumina, but not on silicon nitride.

With respect to the newly introduced feature defining the atomic ratio of Ti and Al in the hard heat-resisting film in the claims of the auxiliary requests 1 and 2, the appellant pointed to the examples in Table 1 of the patent which disclosed a consecutive series of $(\text{Ti}_x\text{Al}_{1-x})\text{N}$ films with increasing x values covering the full range claimed. It could also be derived from Table 1 that samples with $x = 0.1$ and $x = 0.9$ showed unsatisfactory flank wear. Furthermore, original claim 2 disclosed a cubic crystal structure of the hard heat resisting film and thus inherently an atomic ratio in the range of $0.3 < x < 0.7$.

The additional limitations in the claims of the third and fourth auxiliary requests are intended, in the appellant's submission, to distinguish the claimed subject matter still further from document D11/D12 according to which only one particular ultra-fine grain tungsten carbide is disclosed as a base material. The skilled person would refrain from applying the teaching of D11/D12 to base materials not containing carbides.

- IX. The appellant requested that the decision under appeal be set aside and the patent be maintained in amended form on the basis of the main request, subsequently on the basis of the first or second auxiliary request all submitted on 3 April 2007; or subsequently on the basis of the third or fourth auxiliary request submitted during the oral proceedings.

The respondent did not submit any request.

Reasons for the Decision

1. The appeal is admissible.
2. Amendments
 - 2.1 *Main request and third and fourth auxiliary request*

The claims of these requests are properly based on the application documents as originally filed and thus meet the requirement of Art. 123(2) EPC. Their scope has not been extended so that the requirement of Art. 123(3) EPC is also met.

2.2 *First and second auxiliary request*

The originally filed application discloses in claim 3 a hard heat-resisting film having the general formula $(\text{Ti}_x\text{Al}_{1-x})\text{N}$ and an atomic ratio $x = \text{Ti}/(\text{Ti} + \text{Al})$ in the range of $0.3 \leq x \leq 0.5$. Said range of the value x is therefore disclosed only in connection with **nitrides** of Ti and Al.

The values of $x = 0.1$ (claim 1 of the first auxiliary request) and $x = 0.7$ (claim 1 of the first and the second auxiliary request) have been taken from Table 1, examples 1-1 and 1-4, respectively, of the originally filed application. Again, said examples relate to hard films having the general formula $(\text{Ti}_x\text{Al}_{1-x})\text{N}$, i.e., **nitrides** of (Ti,Al).

The claims of the said auxiliary requests are, however, not restricted to hard heat-resisting films of the general formula $(\text{Ti}_x\text{Al}_{1-x})\text{N}$, i.e., to the nitrides, but also encompass films of the **carbides and oxides** of (Ti,Al). In the absence of any relevant additional disclosure in the originally filed application, it is not clearly and unambiguously derivable that also said hard heat-resisting films of said (Ti,Al) carbides and oxides can exhibit the claimed variation of the atomic ratio "x" of $\text{Ti}/(\text{Ti} + \text{Al})$ in the full ranges of $0.1 < x < 0.7$ and $0.3 \leq x < 0.7$ claimed in the first and second auxiliary request, respectively.

The amendments therefore contravene Art. 123(2) EPC and these requests are not allowable.

3. Novelty

Novelty was not disputed during opposition proceedings. None of the documents cited during opposition or appeal procedures discloses all the features of claim 1 of any of the requests in combination.

4. Inventive step

4.1 *Main request*

4.1.1 The document D1/D2 is considered to represent the closest prior art. It discloses a hard composite material for a cutting tool comprising:

a sintered base material having a composition of:

- 1 - 20 vol.-% of aluminium oxide
- 5 - 40 vol.-% of one or more metal carbides or carbo-nitrides selected from carbides of Ti, Ta and W, nitrides of Ti and Ta, and a solid solution of two or more thereof;
- 0.5 - 5 vol.-% of boron nitride
- remainder CBN and inevitable impurities;

and a hard coating layer of TiN having an average thickness of 0.5 μm to 10 μm , optionally on an interlayer of Ti metal (see D2, claim 1; description, paragraph bridging pages 3 and 4; examples). The hard composite material is used in high speed finish cutting of spheroidal graphite cast iron or Fe-based alloy (D2, page 6, paragraphs 2 and 4; and page 8, last paragraph).

Example 1 of D1/D2 specifically discloses a coated cutting tool having an TiN coating of average layer thickness of 6 μm and an ultra-high pressure sintered base material composed of (by vol.-%):

Al₂O₃ 10 %
TiB₂ 2.5 %
TiN 15 %
cBN + impurities: balance.

This cutting tool exhibits no breakage in the wet continuous cutting of spheroidal graphite cast iron (see Table 1, page 7).

4.1.2 The subject matter of claim 1 in accordance with the main request differs from D1/D2 in that

- (1) the hard coating is not composed of TiN, but of a film consisting mainly of Ti, Al and at least one element selected from a group comprising C, N and O;
- (2) in that the film has a crystal structure of the cubic system; and
- (3) in that the cutting tools are for cutting hardened steels.

4.1.3 The technical effect of the claimed subject matter becomes apparent from a comparison between the comparative example 1-31 of Table 1 of the patent in suit (TiN layer according to document D1/D2) and the examples in accordance with the patent. The flank wear of the comparison sample, after cutting a hardened steel rod having a Rockwell hardness of HRC 63 under the conditions set out in paragraph [0043] of the

patent, is marked as "not good", in contrast to the samples having a $Ti_xAl_{1-x}N$ layer.

This is likewise shown in Evaluation 3 (affidavit filed by the appellant during opposition proceedings):

Samples 14 and 17 (cBN sintered bodies coated with TiN according to D1/D2) exhibit higher flank wear in continuous cutting of hardened steel of hardness HRC 61, compared with the same substrates coated with a hard film of TiAlN (examples 15 and 18). Furthermore, this effect is also demonstrated in the additional experimental data annexed to the statement of grounds of appeal. Graphs 1 and 2 (pages 1 and 3 of said annex) reveal the superior flank wear of cutting tools made from sintered cBN bodies coated with films of $Ti_xAl_{1-x}N$. The said improvement is demonstrated for compounds with the atomic ratio $Ti/(Ti + Al) \times x = 0.1, 0.3, 0.5, 0.6, 0.7$ and 0.85 , compared with the same substrate coated with TiN (*i.e.*, according to D1/D2) and for continuous cutting (Graph 1) and interrupted cutting (Graph 2) of hardened steels SUJ2 of HRC 61 and 63, respectively. Another beneficial effect, namely the improvement in chipping resistance, is also shown by these additional data for the said values of atomic ratio.

4.1.4 Starting from D1/D2, the problem underlying the claimed subject matter may be seen in providing a hard composite material for cutting tools having an improved wear resistance and chipping resistance when used for cutting hardened steels.

The statements in particular in paragraphs [0015], [0017], [0021] and [0037] of the patent in suit and the above discussed examples make it plausible that this

object has been achieved essentially over the entire range of molar ratios between Ti and Al. Some less satisfactory examples of the patent in suit cannot outweigh the numerous positive results achieved in the rest of the examples as disclosed in the patent and as submitted later (as discussed above).

- 4.1.5 The question now arises whether the claimed solution is derivable in an obvious manner from the prior art.

The skilled person, confronted with the problem stated above, would consider document D11/D12, which specifically deals with the machining of hardened steels. According to D13, this document was publicly available as of 28 September 1994 which was not contested by the appellant.

This paper reports that TiAlN films, applied on a carbide-based cutting tool in a thickness of about 3 μm , exhibits higher micro Vickers hardness and better adhesion than a TiN film (see D12, page 4, second paragraph; D11, Table 1). The initial oxidation temperature is as high as 840°C, compared with 620°C for a TiN film, which means that the (Al,Ti)N film is stable to temperatures about 220 °C higher than the TiN film (page 4, second paragraph; D11, Figure 3). D11/D12 also describes the superior performance in terms of flank wear of conventionally shaped, 2-teeth carbide cutting endmills coated with (Al,Ti)N, in comparison with the same endmills coated with a TiN film (D12, page 4, last paragraph; D11, Fig. 4). In machining of a hardened SKD 61 steel of HRC 52 at a cutting speed of 30 m/min and a feed rate of 0.05 mm/tooth, only little flank wear and no damage of the sharp edge could be

observed. In the machining of a still harder steel of HRC 60, a hard-type, 6-toothed carbide endmill having an optimised shape and a coating of a (Al,Ti)N hard film was employed; it also showed reduced wear and no chipping, compared with a TiN coated tool (D12, page 5, lines 7 - 12; D11, Fig. 5). Although a still further improvement in chipping resistance can be obtained by using said specially shaped, 6-toothed endmill, the (Al,Ti)N film has superior chipping resistance compared with TiN films (see D12, page 5, lines 10 - 12; page 7, "Conclusion").

It is therefore clear from D11/D12 that carbide cutting tools coated with aluminium/titanium nitride films outperform tools coated with titanium nitride films in the cutting of hardened steels in terms of flank wear and chipping resistance.

In view of these promising results, the skilled person confronted with the problem stated above (point 4.1.4) would contemplate replacing the hard heat-resisting TiN film known from D1/D2 by a TiAlN film, in order to solve the problem posed. He would thus arrive at cutting tools of superior flank wear and chipping resistance when used in the machining of hardened steels, compared with tools coated with TiN. Since this is what is taught in D11/D12, the improvements shown in the patent itself and in later submissions of the appellant (see above) are not surprising.

The appellant has argued that it was impossible to predict the performance of coated cutting tools, since the properties of the coating could not be isolated from those of the base material. He referred to own

experiments (Evaluation 2) showing that a film of (Ti,Al)N behaved differently on an alumina substrate (HC1) and a silicon nitride substrate (SX1). In a cutting experiment with hardened steel (HRC 61), a Si₃N₄ ceramics coated with TiAlN failed prematurely (at 1 km cutting length), whereas the same coating on alumina lasted for a cutting length of 3 km. In addition, TiAlN on alumina gave no significant improvement over TiN films. The appellant concluded that results achieved in D11/D12 in case of a tungsten carbide substrate could also not be transferred to a base material made of a cBN sintered body.

In the board's judgment, this argument cannot, however, prove the existence of a prejudice in the art, because the experimental evidence relied on by the appellant was not part of the prior art and thus not available to the skilled person. Furthermore, the fact that a film of a nitride of a Ti-Al alloy improves the wear resistance of the cutting tool for cutting hardened steel, compared with a TiN film, can be inferred from D14/D15 for another kind of substrate, namely for alumina-based substrates: See in particular paragraphs [12], [13], [19], [21] to [25], Table 1 (examples 2, 4 and 12) and page 9. Document D14/D15 also suggests a mechanisms by which the aluminium in a coating layer made of carbide, nitride or carbonitride of a Ti-Al alloy improves wear resistance, stating that *"a part of the Al included in the coating layer causes a chemical reaction due to a high temperature generated during a cutting process, thereby creating Al₂O₃ capable of improving the wear resistance property"* (see paragraph bridging pages 4 and 5).

The appellant has also referred to document D17, disclosing cutting tools comprising a sintered body of high-pressure phase boron nitride (BN) and a coating selected from titanium nitride, titanium carbide and aluminium oxide (see claim 1). After a discussion of the advantageous properties of cubic boron nitride, in particular its high hardness and of its drawbacks in terms of manufacturing cost, it is stated at page 3, first sentence, that *"it is conventionally believed that a large effect cannot be obtained even if the surface of a cutting tool is coated with a ceramic material having a lower hardness than that of the high-pressure phase boron nitride"*. In the appellant's view, D17 thus teaches away from using a coating of a hardness lower than the one of the base material, such as titanium aluminium nitride on a sintered body of cBN having a higher hardness (3,500 to 4,300 HV).

The board does not, however, find this argument convincing, because document D17 already discloses in claim 1 a cutting tool coated with a TiN film and made of a sintered body including high-pressure phase boron nitride. Said sintered body including high-pressure phase boron nitride may comprise cubic boron nitride (cBN) and wurtzite type boron nitride (WBN) (see page 1, penultimate paragraph); its hardness is next to that of diamond (page 2, last sentence). A cutting tool comprising 48 vol.-% WBN, 36 vol.-% TiN and 16 vol.-% aluminum coated with a 3 µm film of TiN performed satisfactorily in the machining of hardened steel of Rockwell hardness HRC 68 (see page 6, Embodiment 1). Therefore, even if there was a prejudice in the art against using softer coatings such as TiN on high-hardness boron nitride, it was overcome by document D17

itself. The appellant referred to page 4, lines 13 - 17 of D17, disclosing the deposition of tantalum carbide (TaC) as a further layer to obtain a cutting tool exhibiting superior characteristics. However, contrary to the appellant's assertion, this additional hard coating of TaC is not mandatory, as can be seen from claim 1 (alternative 1).

Claim 1 of the main request and of the auxiliary requests 3 and 4 call for a hard film having a crystal structure of the **cubic** system. As can be seen from examples 1-1 to 1-5 in Table 1 of the opposed patent, the compound $Ti_xAl_{1-x}N$, in analogy to TiN, exists in the cubic crystal system when the atomic ratios x falls in the broad range of $0.3 < x \leq 0.9$. The appellant has confirmed during oral proceedings that the crystal structure (cubic or hexagonal) of $Ti_xAl_{1-x}N$ changes with the composition, *i.e.* the atomic ratio x , the method of preparation having no significant influence.

D11/D12 is silent about the crystal structure of the (Al,Ti)N film and does also not explicitly disclose a specific Ti/Al ratio. Under these circumstances, to put the teaching of D11/D12 into practice, the skilled person would carry out a series of routine experiments covering various atomic ratios of Al and Ti, in order to determine the most appropriate composition of the film. He would thereby find out without exercising any inventive skill that appropriate coatings fall in the range of x where the film made of $Ti_xAl_{1-x}N$ has a cubic structure. Further information in this respect, if needed, could be taken from document D15, where it is explained at page 8 (footnote to Table 1) that TiAlN

refers to a nitride of an alloy of 50 wt.-% Ti and 50 wt.-% Al.

All features of claim 1 are thus derivable in an obvious manner from D1/D2 and D11/D12, and optionally D15. Therefore, the subject matter of claim 1 of the main request does not involve an inventive step.

4.2 *Third and fourth auxiliary request*

4.2.1 Claim 1 of the third auxiliary request is further limited, as far as variant (1) thereof is concerned, to cBN sintered bodies obtained by using a binder powder comprising at least one member selected from a group comprising nitride, carbide, boride and oxide of titanium and their solid solutions, and aluminum and/or aluminum compounds. Claim 1 of the fourth auxiliary request is still further limited, as far as variant (1) thereof is concerned, to cBN sintered bodies obtained by using a binder powder comprising nitride of titanium and aluminum and/or aluminum compound. In claim 1 of both requests, WC has been deleted from the list of binder materials in variant (2).

In the appellant's submission, these limitations are intended to distinguish the claimed subject matter still further from document D11/D12 according to which a specific ultra-fine grain tungsten carbide base material of HRA 91.5 is used (see D12, page 2, last line, to page 3, line 3). There was thus no motivation at all to apply the teaching of D11/D12 to base materials free from carbides and completely different from D11/D12.

4.2.2 The board considers that for the subject matter of claims 1 of the third and fourth auxiliary requests the technical problem is the same as defined above for the main request.

4.2.3 The board also considers that regarding inventive step essentially the same arguments as for the main request apply, because it was obvious to apply the (Al,Ti)N coating taught in D11/D12 on cBN sintered bodies known from D1/D2, no matter whether they contain carbides or not. The board observes that TiN and aluminium compound, which are binders for the cBN sintered bodies in accordance with variant (1) of claim 1 of both the third and the fourth auxiliary requests, are also among the preferred binders for the sintered base material in accordance with D1/D2; see claim 1; page 7, example 1 (in which the Al compound is Al_2O_3). As discussed above, the superiority of an (Al,Ti)N coating over a TiN coating in terms of flank wear can be inferred from D11/D12 on an ultra-fine grain WC-based substrate and from D14/D15 for an alumina-based ceramic substrate. The appellant has not shown a prejudice existing in the art against using this coating on harder substrates, in particular the sintered body of cBN disclosed in D1/D2. Therefore, the skilled person had no reason to assume that the benefits of the (Ti,Al)N coating layer could not be achieved on a high-pressure sintered body of cubic boron nitride as disclosed in D1/D2.

The subject matter of claim 1 according to the third and fourth auxiliary requests thus also does not involve an inventive step. These requests are therefore not allowable, either.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar

The Chairman

C. Vodz

M. Eberhard