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# Datasheet for the decision of 28 May 2014

**Case Number:** T 1905/10 - 3.2.07

**Application Number:** 00913591.4

**Publication Number:** 1157143

**IPC:** C23C16/36, C23C16/44

**Language of the proceedings:** EN

**Title of invention:**
MT CVD PROCESS

**Patent Proprietor:**
KENNAMETAL INC.

**Opponent:**
Sandvik AB

**Headword:**

**Relevant legal provisions:**
EPC Art. 83, 123, 111(1)

**Keyword:**
Sufficiency of disclosure - main request (no)
Sufficiency of disclosure - auxiliary request (yes)
Amendments - allowable (yes)
Remittal to the department of first instance - auxiliary request 1 (yes)

**Decisions cited:**
T 0931/91, T 0339/05, T 0369/05, T 0063/06

**Catchword:**

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**Boards of Appeal**
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**Case Number: T 1905/10 - 3.2.07**

# D E C I S I O N
# of Technical Board of Appeal 3.2.07
# of 28 May 2014

| | |
|---|---|
| **Appellant:** (Patent Proprietor) | KENNAMETAL INC.<br>P.O. Box 231<br>Latrobe, PA 15650-0231 (US) |
| **Representative:** | Prinz & Partner<br>Patentanwälte<br>Rundfunkplatz 2<br>80335 München (DE) |
| **Respondent:** (Opponent) | Sandvik AB<br>S-811 81 Sandviken (SE) |
| **Representative:** | Weber, Roland<br>WSL Patentanwälte Partnerschaft mbB<br>Kaiser-Friedrich-Ring 98<br>65185 Wiesbaden (DE) |
| **Decision under appeal:** | **Decision of the Opposition Division of the European Patent Office posted on 29 June 2010 revoking European patent No. 1157143 pursuant to Article 101(3)(b) EPC.** |

**Composition of the Board:**

| | |
|---|---|
| **Chairman** | H. Meinders |
| **Members:** | H. Hahn |
| | E. Kossonakou |

## Summary of Facts and Submissions

I. The patent proprietor (appellant) lodged an appeal against the decision of the Opposition Division to revoke European patent No. 1 157 143.

II. In the present decision the following document of the opposition proceedings is cited:

Diagram "TiCN thickness versus position and % HCl" based on experimental results submitted by the opponent (respondent) with its letter of 17 May 2010,

while the following documents were submitted in the appeal procedure:

D17 = Experimental report of Kennametal dated 7 July 2010.
D18 = Experimental report of Kennametal dated 27 September 2010.

III. An opposition had been filed against the patent in its entirety under Article 100(a) EPC, for lack of novelty and inventive step. An additional ground of opposition under Article 100(b) EPC, that the patent does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by the person skilled in the art, had been filed by the opponent with its letter dated 17 May 2010 about one month before the oral proceedings before the Opposition Division, scheduled for 16 June 2010.

The Opposition Division held at the oral proceedings that the new ground for opposition under Article 100(b) EPC, although having been late filed, was admissible for being *prima facie* relevant. The Opposition

Division, taking account of the results of the experiments carried out by the opponent as presented in the same letter, considered that the patent and its invention lacks disclosure (Article 83 EPC), sufficient enough to enable the skilled person to obtain substantially all embodiments falling within the ambit of claim 1. Consequently, the patent was revoked.

IV. With a communication dated 10 February 2014 and annexed to the summons to oral proceedings the Board presented its preliminary opinion with respect to the single request (i.e. the patent as granted) underlying the impugned decision and with respect to the auxiliary request as filed with the statement setting out the grounds of appeal dated 8 November 2013.

With respect to the main request the Board remarked amongst others that it should be discussed whether the experiment with non-deposition of TiCN at 30% HCl amounts to an objection under Article 83 EPC, taking account of the established case law which allows for occasional failure. Furthermore, it should be discussed whether the new tests of D17 and D18 are suitable to rebut the comparative tests performed by the opponent or to prove that an occasional failure occurred.

The Board further remarked that the auxiliary request appeared not to be formally allowable for contravening Article 123(2) EPC.

V. With letter dated 16 April 2014 the appellant filed, as a response to the Board's communication, first to third auxiliary requests in combination with arguments concerning the basis of the amendments made therein as well as further arguments with respect to the main

request and the objections raised thereto under Article 83 EPC.

VI. With letter dated 22 April 2014 the respondent, also as a response to the Board's communication, submitted further informations concerning the Bernex 200 CVD reactor used for the opponent's experiments and additional data of the same as well as arguments with respect to the issue of an occasional failure in performing the invention.

VII. Oral proceedings before the Board were held on 28 May 2014. First, the issue of compliance of claim 1 of the main request with Article 83 EPC was discussed. Thereafter it was discussed whether there exist any objections against the claims of auxiliary request 1 as regards their admissibility or under the requirements of Article 83 EPC.

a) The appellant requested that the decision under appeal be set aside and that the case be remitted to the department of first instance for further prosecution on the basis of the main request (patent as granted) or on the basis of one of the auxiliary requests 1 to 3, all filed with letter dated 16 April 2014, once compliance of the relevant claims with the requirements of Article 100(b), respectively 83 EPC has been established.

b) The respondent requested that the appeal be dismissed, alternatively that the case be remitted to the department of first instance for further prosecution.

At the end of the oral proceedings the Board announced its decision.

VIII. Claim 1 of the patent as granted according to the main request reads as follows:

"1. A MT CVD process comprising the steps of:
a) heating at least one substrate in a reaction chamber to a reaction temperature, said at least one substrate having a surface; and
b) introducing into said reaction chamber a deposition process gas comprising from 1 to 30% hydrogen halide and predetermined amounts of a carbon/nitrogen source, a metal-halogen compound, and $H_2$ so that a carbonitride-containing coating deposits on said surface of said at least one substrate.".

IX. Claim 1 of auxiliary request 1 reads as follows (amendments as compared to claim 1 of the patent as granted are in bold; emphasis added by the Board):

"1. A MT CVD process comprising the steps of:
a) heating at least one substrate in a reaction chamber to a reaction temperature, said at least one substrate having a surface; and
b) introducing into said reaction chamber a deposition process gas comprising from **2.3 to 20% HCl, from 0.3 to 0.7% $CH_3CN$, from 0.9 to 2.1% $TiCl_4$, from 10 to 30% $N_2$, and from 50 to 85% $H_2$** so that **a coating of TiCN** deposits on said surface of said at least one substrate."

X. The claims 1 of auxiliary requests 2 and 3 are identical with those of auxiliary request 1.

XI. The appellant argued, insofar as relevant for the present decision, essentially as follows:

It is well established case law that an invention is in principle sufficiently disclosed if at least one way is clearly indicated enabling the person skilled in the art to carry out the invention. The patent in suit discloses various examples and it was not disputed that these examples are reproducible.

It is within the skilled person's common general knowledge to vary these tests, without undue burden, in order to perform the invention in the whole range as claimed in claim 1 of the patent as granted according to the main request. This is clearly demonstrated by the test results presented in D17 and D18.

The respondent has shown with its experiments that it can carry out the process of claim 1 of the patent as granted over the whole range of 1-30% hydrogen halide (the respondent used HCl) but that it did not obtain the desired result, i.e. the deposition of a carbonitride-containing coating on the substrate at the value of 30% HCl. This value - which is not a preferred one - is at the end of the range of claim 1 and is not technically significant, due to the implicit corrosive reactor conditions. Thus the invention fell short only once at the end of the claimed range but could still be carried out within the rest of the scope of claim 1 of the patent as granted. Therefore there is only an occasional failure, which according to the established jurisprudence is not problematic. This has also been proven by the experiments according to D17 and D18 with HCl concentrations of 20.3% and 30.8%, and 20.04% respectively, with at least some deposition.

The jurisprudence that the invention has to be disclosed such that it can be performed over the whole range claimed, addresses only functional features, such

as chemical formulae where only some members of the claimed class could be performed. Claim 1 of the patent as granted does not contain such a functional definition nor does it represent a reach-through claim.

The tests performed by the respondent have been conducted with the clear desire of failure - namely the statement of the expert that the claimed CVD process for the deposition of TiCN cannot work at a HCl concentration of 30% - and are therefore not appropriate to demonstrate an insufficiency of disclosure. The burden of proof lies with the opponent to establish that the tests have been performed accurately.

The starting conditions of the examples according to the patent in suit and those of the comparative tests performed by the respondent are different since they are based on different reactors having different volumes and different pre-heating arrangements. Therefore the (occasional) failure at 30% could reside in a difference of the parameters, which difference may make sense in certain technical areas but not with respect to CVD processes, where the reactor design is important.

Furthermore, it is clear to the person skilled in the art that he cannot simply add HCl to the deposition gas composition according to the (comparative) example B of the patent in suit as done by the respondent but that he has to compensate for this HCl addition by changing the concentration of the other components. The skilled person would not start from an example not containing any HCl and then increase the concentration thereof up to the maximum amount.

Although there are only marginal differences between the deposition gas compositions of the examples A and B of the patent in suit the skilled person is taught by the examples that for increased HCl concentrations he has to increase the concentrations of $TiCl_4$ and of $CH_3CN$ as well.

Little can be said with respect to the change of at least 6 parameters according to test 2 of D17 when compared to the respondent's tests based on example B of the patent in suit. It is a CVD process performed in a commercial reactor and not in a laboratory scale reactor.

Consequently, the invention of claim 1 of the main request complies with Article 83 EPC.

Claim 1 of auxiliary request 1 is based on claims 1 and 21 of the patent as granted, corresponding to claims 15 and 21 of the application as originally filed (identical with the published WO-A-00/52224). The dependent claims 2-9 of auxiliary request 1 are based on claims 22; 23; 26 and 32; 37 and 43; 33; 33 and 45; 24, 30, 35, 41 and 46; and 25, 31, 36, 42 and 47 of the WO-A-00/52224, respectively. Therefore the requirements of Articles 123(2) and (3) are complied with.

Since the impugned decision was based on the finding of the Opposition Division that no TiCN deposition takes place with a deposition gas comprising 30% HCl, that conclusion can no longer hold in view of claim 1 of auxiliary request 1 which has been restricted to a HCl concentration range of from 2.3 to 20% HCl. Therefore the invention of claim 1 of auxiliary request 1 complies with Article 83 EPC.

XII. The respondent argued, insofar as relevant for the present decision, essentially as follows:

It is established jurisprudence that an invention is only sufficiently disclosed if it can be performed in the whole range claimed. Claim 1 of the patent as granted represents a broad claim which due to its definition "so that a carbonitride-containing coating deposits ..." is not restricted to either titanium compounds or to carbonitrides being used. Therefore the skilled person should be enabled to carry out the invention of claim 1 of the patent as granted over the entire range claimed.

The argument that the end value of 30% HCl would not be technically relevant cannot hold since it is not plausible why this value is nevertheless claimed, if it were true that nobody would work in that area. If a certain broad range is claimed then the skilled person should be enabled to work in the entire range.

A - in the meantime retired - senior expert of the respondent's company was convinced that the claimed CVD process would not work at a HCl concentration of 30%. Therefore the examples of the patent in suit were chosen as a starting point for its comparative tests, in order to work as close as possible to what the patent disclosed. The components and the compositions as well as the other specified process parameters of these comparative tests (as exactly specified in the letter dated 22 April 2014, page 6, tables) are within the preferred ranges of the patent in suit so the appellant cannot raise any objection in this respect. Furthermore, it is refuted that the respondent's experiments were made with an intention to obtain a failure.

Although it is true that not all CVD reactors are equal or similar, claim 1 of the patent as granted does not show any corresponding limiting feature with respect to the reactor to be used. Consequently, it should be possible to carry out the claimed CVD process in any CVD reactor.

The deposition of a compound such as TiCN is not only determined by the geometry of the reactor but it is also important **where** the first deposition will start. About two-thirds of the CVD deposition takes place in the pre-heating zone of the reactor while the remaining third takes place in the trays of the reactor. This explains the differences in the obtained coating thicknesses between the axial reactor used by the respondent (see letter of 22 April 2014, figures 1(a) to 1(c)) and the reactor used for the examples of the patent in suit (compare patent, figure 1). No discrepancies can be seen in this respect.

Test 2 of the experiments according to D17 was performed with a composition and at a process temperature quite different from the preferred ranges of the patent in suit (see claims 21 and 23) which include those of the examples (see tables 1 and 2). Namely, the composition according to this test did not contain any nitrogen but contained amounts of $TiCl_4$ (2.89%) and of $CH_3CN$ (1.64%) which are higher than those of the preferred ranges of the patent in suit and also the applied temperature was higher (900°C) than that of the preferred range (830-880°C).

Contrary to the appellant's arguments D17 does not prove an occasional failure. It represents the opposite of the jurisprudence according to T 931/91 (not

published in OJ EPO) since, starting from the examples of the patent in suit, there are more than just a few attempts necessary to transform the failure at 30% HCl into success. This is due to the fact that the conditions and parameters according to said test 2 of D17 are not within but only outside the preferred ranges of the patent in suit. Furthermore, the patent in suit is silent with respect to any measures that would be necessary to compensate for the addition of HCl to the deposition gas as argued by the appellant. Its examples were only made with compositions comprising 4.7% HCl and 6.5% HCl. Therefore the person skilled in the art would start from these deposition gas compositions according to the examples when trying to increase the HCl concentration. The patent in suit is also silent with respect to a deposition using HCl concentrations different from those of the examples and does not give any instructions to the person skilled in the art how to compensate for HCl concentration changes.

In view of the concentrations used for examples A and B it is not apparent that the concentrations for $TiCl_4$ and $CH_3CN$ should be higher since those for example A (which comprised 4.6% HCl) are lower than the corresponding concentrations of example B without any HCl. The same holds true for examples D to G likewise made with 4.6% HCl.

The "adaption" of example C of the patent in suit with a concentration of 7.5% HCl, although comprising slightly higher amounts of $TiCl_4$ and $CH_3CN$ than the examples A and B, is still within the preferred ranges of the patent in suit, contrary to the concentrations of the composition of test 2 of D17.

With respect to an occasional failure it is also remarked that, based on the results of the respondent's experiments, the diagram of the average deposition thickness shows a drastic decrease of the deposition at the amounts of 15% HCl and 20% HCl. Considering the tendency of the decreasing average deposition thicknesses it can be expected that at 30% HCl no deposition would occur since the dotted trend-line already at about 27% HCl reaches the value zero (see letter dated 22 April 2014, page 10, diagram).

Therefore the invention of claim 1 of the main request does not comply with Article 83 EPC.

There are no formal objections against the claims of auxiliary request 1. Likewise no objection under Article 83 EPC is raised.

## Reasons for the Decision

*1. Sufficiency of disclosure (Article 83 EPC)*

*Main request*

1.1 The Opposition Division in its impugned decision concluded that the respondent's experiments (see point II above) are within the wording of claim 1 of the patent as granted, which contains no limitations concerning the apparatus, temperature and gas flows. It considered that the examples only disclose HCl concentrations of 4.6% and 7.5% HCl. It held that the experiments unambiguously demonstrate that when carrying out the invention of the patent in suit with a deposition process gas comprising 30% HCl no TiCN deposition takes place on any of the substrates. It therefore concluded that "the skilled person is not

able to obtain substantially all embodiments falling within the ambit of claim 1" (see point 3.2 of the reasons).

1.2 Since the appellant failed to show that the impugned decision is wrong the Board reaches the same conclusion with respect to Article 83 EPC for the following reasons.

1.3 First of all, the process of claim 1 of the patent as granted - comprising the two steps a) and b) - does **not** require any specific CVD reactor, or specific flow rates, or specific temperatures but only requires introducing into the heated reaction chamber a deposition process gas comprising from **1-30%** hydrogen halide and predetermined amounts of a carbon/nitrogen source, a metal-halogen compound, and hydrogen, so that a carbonitride-containing coating deposits on the substrate surface (see point VIII above).

Furthermore, the patent in suit explicitly states in paragraph [0059] with respect to the CVD reactor type or its design "Although the foregoing examples were conducted in a conventional reaction vessel chamber of the design described above, it is to be understood that **the present invention may be practiced in any design of reaction chamber known to those skilled in the art to be adaptable for use with conventional MT CVD**".

Consequently, the appellant's arguments that the non-deposition of TiCN at a concentration of 30% HCl according to the opponent's experiments would be caused by the use of another CVD reactor having a different geometry and size that inevitably results in different gas flows in the trays as compared to the CVD reactor described in the patent in suit (see paragraph [0033])

cannot hold. In this context the Board also considers that it cannot be expected that the respondent has a reactor identical with the one described in the patent in suit for carrying out comparative experiments. Furthermore, the gas flows as given in test B of the patent in suit have been re-calculated by the respondent to suit the reactor size of the Bernex 200 reactor underlying its experiments.

1.3.1 Claim 1 of the patent as granted according to the main request is also **not** restricted to the deposition of TiCN which is the only compound deposited according to the examples 1 and 3-6 corresponding to the tests A and C-G and their reaction conditions (see patent in suit, table 1).

The deposition gas composition according to example A thus contained (in %) 4.6 HCl, 0.4 $CH_3CN$, 1.3 $TiCl_4$, 77.1 $H_2$ and 16.5 $N_2$. The deposition gas composition of tests D, E and G is identical. The deposition gas composition according to example C contained 7.5 HCl, 0.7 $CH_3CN$, 2.1 $TiCl_4$, 62.8 $H_2$ and 26.9 $N_2$, while that of example F contained (in %) 4.6 HCl, 0.3 $CH_3CN$, 0.9 $TiCl_4$, 77.6 $H_2$ and 16.6 $N_2$ (see table 1).

The deposition gas compositions (i.e. the concentrations of the components HCl, $CH_3CN$, $TiCl_4$, $H_2$ and $N_2$) and the reaction conditions (i.e. a reaction temperature of 870°C or of 830°C/870°C; and a reaction pressure of 120 Torr) of these tests A and C-G, made with either 4.6% HCl (tests A and D-G) or 7.5% HCl (example C), are within the two composition ranges mentioned in paragraph [0023] and the corresponding parameter ranges mentioned in paragraphs [0024] and [0025] of the patent in suit, which correspond to the

preferred ranges of the claimed MT CVD process specified in its dependent claims 21 and 23, namely from 2.3 to 20% HCl, from 0.3 to 0.7% $CH_3CN$, from 0.9 to 2.1% $TiCl_4$, from 50 to 85% $H_2$, and from 10 to 30% $N_2$. Further, a reaction temperature in the range of 830 to 880°C and a reaction pressure of 40 to 120 Torr were used.

1.3.2 Therefore the Board is satisfied that the patent in suit discloses at least one way for carrying out - a part of - the invention, namely the deposition of **TiCN** from a deposition gas comprising 4.6% HCl and 7.5% HCl besides $CH_3CN$, $TiCl_4$, $H_2$ and $N_2$, which is supported by the five tests A and C-G according to the examples 1 and 3-6.

This conclusion is also supported by the respondent's experiments at varying HCl concentrations in the deposition gas composition of (in %) 7, 10, 15, and 20 HCl, respectively, which all resulted in a deposition of TiCN on the substrates.

1.3.3 However, according to the case law the disclosure of one way of performing an invention is sufficient **only** - as correctly considered by the Opposition Division in its decision - if it allows the invention to be performed **in the whole range claimed** and without undue burden. Sufficiency of disclosure thus presupposes that the skilled person is able to obtain substantially all embodiments falling within the ambit of the claims (see Case Law of the Boards of Appeal, 7th edition 2013, sections II.C.4.2 to II.C.4.4).

The mere statement "disclosing one way of performing the invention suffices for compliance with Article 83

EPC" is an incorrect simplification of the jurisprudence of the Boards of Appeal.

The appellant's argument that the relevant jurisprudence would address only functional features cannot hold since the above elaborated principle applies to any invention irrespective of the way in which it is defined (see Case Law of the Boards of Appeal, 7th edition 2013, II.C.4.4; see e.g. T 369/05, not published in OJ EPO, point 3.3 of the reasons).

Further, the wording of feature b) of claim 1 of the patent as granted "introducing into said reaction chamber a deposition gas ... **so that a carbonitride-containing coating deposits** on said surface of said at least one substrate" (see point VIII above) defines a result to be achieved, i.e. feature b) of claim 1 represents a functional feature as well.

Furthermore, the appellant's argument that the end value of 30% HCl would not be technically relevant is irrelevant taking account of the established jurisprudence which requires that the invention can be performed in the whole range claimed.

1.3.4 This aforementioned condition, however, is **not** fulfilled by the patent in suit - as proven by the respondent's experiment at 30% HCl - for the following reasons.

1.4 Example B of the patent in suit has a deposition gas composition very similar to those of the examples A and D-G due to its amounts (in %) of 0.5 $CH_3CN$, 1.4 $TiCl_4$, 80.9 $H_2$ and 17.3 $N_2$. It is stated to represent an example comparative to the invention of the patent in

suit of a conventional MT CVD deposition without any addition of HCl to the deposition gas composition.

1.4.1 The Board considers that the person skilled in the art, when aiming to perform the claimed invention of the patent in suit in its broadest scope, i.e. to perform the claimed MT CVD process with a deposition gas composition comprising from 1 to 30% hydrogen halide as specified in claim 1 of the main request, would - since the description and particularly the detailed description is silent in this respect - either start from the examples disclosed in the patent in suit (i.e. tests A and C-G), or alternatively, would start from the (true) comparative example that is **only** distinguished from the inventive examples by the omission of a single feature, namely the non-presence of a hydrogen halide. Test B represents such a comparative example. Both are equally feasible approaches.

1.4.2 Thus the skilled person when starting from the examples A and C-G is expected to either increase the amount of HCl in their deposition gas compositions up to the maximum value of 30% HCl or, when starting from the comparative example B, he is expected to start adding HCl to the deposition gas composition of example B up to the maximum value of 30% HCl as done by the respondent in its experiments. Furthermore, the person skilled in the art is expected to apply the reaction temperatures and reaction pressures of the examples and to use a CVD reactor similar to the one described in the context of these examples.

1.4.3 Since the description of the patent in suit is silent about how a compensation for an increasing HCl content in the deposition gas composition has to be achieved,

e.g. whether the concentration of $H_2$ or $N_2$ has to be reduced when the amount of HCl is to be increased, the skilled person could select any of the two. In case that HCl is added to a deposition gas composition without any nitrogen then it will automatically be the $H_2$ which will be replaced.

1.4.4 In this context it is likewise clear to the skilled person that

a) considering the chemistry of the CVD deposition of TiCN due to the underlying sum reaction:

$TiCl_4 + CH_3CN + 2\ ½\ H_2 + N_2 \rightarrow TiCN + 4\ HCl + CH_4 + N_2$

$H_2$ is a reactant which contributes to HCl formation and the reduction of the carbon/nitrogen source whereas $N_2$ is an inert gas not taking part in the deposition reaction; and

b) taking account of the very large molar excess of $H_2$ (based on the assumption that the molar ratios of the gaseous reactants correspond more or less to their volume proportions, i.e. vol.%, which assumption is only fully correct for ideal gases but sufficient in the context of this estimation) compared to the low molar amount of $H_2$ necessary for the aforementioned deposition reaction most of the $H_2$ acts (likewise as the $N_2$) as carrier gas only.

This conclusion is also plausible in view of the fact that a (lowered) $H_2$ concentration of the thereby resulting deposition gas compositions according to the respondent's experiments starting from the composition of test B (which contained 80.9% $H_2$) - i.e. after a

compensation for an increasing HCl amount of (in %) 7, 10, 15, 20, 25, and 30 HCl the compensated $H_2$ concentration is 73.9, 70.9, 65.9, 60.9, and 50.9, respectively - is still within the preferred range of about 40% to about 98% $H_2$ mentioned in paragraph [0023] of the patent in suit.

1.4.5 Taking account of the respondent's plausible explanations concerning the influence of a different reactor geometry and adapted gas flow on the deposition of the carbonitride compound in a CVD reactor, namely where the deposition of TiCN starts, the appellant's argument that the respondent had the intention to obtain a failure at high HCl concentrations are, without any evidence in support thereof, considered to be mere allegations.

1.4.6 Consequently, from the Board's point of view the respondent's experiments at 30% HCl starting from example B cannot be objected to and the appellant's corresponding arguments to the contrary cannot hold. As discussed in points 1.4.1 and 1.4.2 above, there exists no plausible reason for the person skilled in the art, particularly in view of the missing information in the patent in suit concerning any compensation for the increase in the HCl concentration in the deposition gas composition, not to start from the deposition gas composition of test B of the patent in suit and then to increase the HCl concentration up to the claimed maximum amount of 30% HCl.

1.4.7 The appellant's arguments that the burden of proof lies with the respondent to establish that the tests have been performed accurately cannot hold.

This is due to the fact that the patent in suit has been revoked by the impugned decision and that the respondent - in accordance with the established case law (see e.g. T 63/06, not published in OJ EPO, points 3 to 3.3.4 of the reasons) - on the basis of its comparative experiment with a deposition gas composition comprising 30% HCl has shown that no TiCN was deposited on the substrates in the trays of the CVD reactor, i.e. that the common general knowledge does **not** enable the person skilled in the art to put the functional feature of the deposition of a carbonitride-containing coating on the substrate surface at 30% HCl into practice. These two facts shift the burden of proof to the appellant. The appellant has not, however, submitted sufficient evidence to show the opposite and to discharge its burden of proof (compare point 1.5 below).

1.5 In order to rebut the respondent's experiments the appellant submitted the counter-experiments D17 (tests 1 and 2 with 20.34% and 30.8% HCl) and D18 (with 20.04% HCl). The tests of D17 were conducted in a TC Kencoat furnace (#2) and an Orwell Kencoat furnace (#44) - which are stated to correspond to that of figure 1 of the patent in suit - while the test of D18 was carried out in said TC Kencoat furnace #2 but with a modified gas inlet.

1.5.1 However, **neither** the tests of D17 **nor** those of D18 have been made in agreement with the deposition gas compositions and reaction conditions of the examples (tests A and C-G) according to Tables 1 and 2 of the patent in suit, let alone those starting from test B used in the experiments of the opponent (compare point 1.4 above):

- the concentration of **30.8%** HCl according to test 2 of D17 lies outside the range of 1 to 30% HCl specified in claim 1 of the main request;
- the tests of D17 and D18 were performed at a different reaction pressure (i.e. 76 Torr compared to 120 Torr and 90 Torr specified for test A-D and G, and tests E and F, respectively; see Table 2 of the patent in suit);
- different deposition times were used (tests 1 and 2 of D17 used 100 and 75 minutes, respectively compared to 180 minutes of D18 and tests A-G);
- different (D18) or unspecified flow rates (D17) were used;
- the deposition gas composition of tests 1 and 2 of D17 did not comprise any $N_2$ at all while that of D18 contained (in %) 18.7 $N_2$ compared to 16.5, 17.3, 26.9, 16.5, 16.5, 16.6 and 16.5 $N_2$ according to tests A-G, respectively;
- tests 1 and 2 of D17 used (in %) 3.1 and 2.89 $TiCl_4$ while D18 used 1.88 $TiCl_4$ compared to 0.9-2.1 according to tests A-G; and 1.3 and 1.64 $CH_3CN$ (tests 1 and 2 of D17) and 0.61 $CH_3CN$ (D18) compared to 0.3-0.7 $CH_3CN$ according to tests A-G; and
- higher temperatures of 880-900°C and 900°C (tests 1 and 2 of D17) and 880-900°C (D18) were used instead of 870°C or 830/870°C according to tests A-C and G, and D and E, respectively.

1.5.2 Hence, these tests of D17 and D18 - which were performed with different deposition gas compositions and process parameters than the ones used in the respondent's experiments - are **not** suitable to rebut the comparative tests made by the respondent and particularly not the test with no TiCN deposition at 30% HCl.

Therefore the Board considers that the appellant has **not** produced or submitted counter-experiments which would prove that with the reaction conditions and a modified deposition gas composition starting from test B as used in the experiments of the respondent, i.e. comprising 30% HCl, it would be possible to produce a TiCN coating on the substrates at all, let alone with thickness values in the range as given in table 3 of the patent in suit.

1.6 According to the established case law the disclosure of an invention must be reproducible without undue burden but allows for an occasional failure which according to the jurisprudence could be established if only few attempts are required to transform failure into success, provided that these attempts are kept within reasonable bounds and do not require inventive step (see Case Law of the Boards of Appeal, 7th edition 2013, section II.C.5.6.2; T 931/91, not published in OJ EPO).

The Board considers that, contrary to the appellant's arguments, the experiment of test 2 of D17 does **not** prove an occasional failure at 30% HCl for the following reasons.

1.6.1 Firstly, it is apparent from the tendency of the decreasing average deposition thickness of TiCN in the diagram of the average deposition thicknesses based on the respondent's experiments (see respondent's letter of 22 April 2014, page 10, diagram) that no deposition would occur at 30% HCl since the dotted trend-line of this average deposition thickness already at about 27% HCl reaches the value zero. Consequently, it is clear that there is no occasional failure at a single HCl concentration point.

When asked by the Board at the oral proceedings, the appellant did not make any comment with respect to the trend shown in this diagram but only stated that the person skilled in the art would not start from an example (i.e. like example B) not containing HCl.

1.6.2 Secondly, the conditions and parameters according to said test 2 of D17 have been modified considerably as compared to those of the respondent's example at 30% HCl and those of the examples of the patent in suit (compare points 1.3.1, 1.4 and 1.5.1 above) and are outside the preferred ranges of the patent in suit.

When asked by the Board at the oral proceedings that at least 6 parameters have been modified according to test 2 of D17 as compared to the respondent's experiment with 30% HCl based on test B of the patent in suit, the appellant stated that not much more can be said in this respect other than that the experiments of D17 were made in a commercial reactor and not in a laboratory scale one. This answer, however, does not explain why these at least six parameters (i.e. the reaction temperature, the reaction pressure, and the concentrations of $CH_3CN$, $TiCl_4$,$H_2$ and $N_2$) have been modified and particularly, why they have been modified in this specific manner.

The Board considers that the skilled person is not in a position to complete the missing information - the specification of the patent in suit is silent with respect to any compensation for an increasing amount of HCl, let alone with respect to an adaption of the concentrations of the components $CH_3CN$ and $TiCl_4$ for the deposition of TiCN at higher HCl concentrations or how these concentrations should be adapted in combination

with any other process parameters - concerning the compensation of any changes of the HCl concentration in the range of 1 to 30% HCl by using his common general knowledge. He therefore has to carry out a number of experiments based on the disclosure of the examples which amount to a small research program (see T 339/05; not published in OJ EPO, point 3.6 of the reasons).

The appellant's argument that the skilled person would be taught by the examples of the patent in suit that the concentrations of $CH_3CN$ and $TiCl_4$ should be increased for high(er) HCl concentrations cannot hold. The majority of these examples, i.e. tests A and D-G, uses lower concentrations of $CH_3CN$ and $TiCl_4$ than the comparative test B (without addition of HCl) at a comparable total gas flow while test C although using somewhat higher concentrations of $CH_3CN$ and $TiCl_4$, used a much lower total gas flow (see tables 1 and 2). Furthermore, there is no suggestion at all to the person skilled in the art in the patent in suit to omit the $N_2$ - which is comprised in all the compositions of the tests A-G -from the deposition gas composition.

1.7 Therefore, the invention of claim 1 of the patent as granted according to the main request, in the light of the description and the figures of the patent in suit, does not comply with Article 83 EPC. The main request is therefore not allowable.

*Auxiliary request 1*

1.8 Process claim 1 of auxiliary request 1 has been restricted to a deposition gas composition containing from 2.3 to 20% HCl, from 0.3 to 0.7% $CH_3CN$, from 0.9 to

2.1% $TiCl_4$, from 10 to 30% $N_2$, and from 50 to 85% $H_2$ and to a resulting coating of TiCN (see point IX above).

1.8.1 Besides the five examples of the patent in suit executed with a coating of TiCN from deposition gas compositions comprising 4.6 or 7.5% HCl (see points 1.3.1 and 1.3.2 above) it is also evident from the diagram of the average deposition thicknesses based on the respondent's experiments that a coating of TiCN is deposited within the concentration range of 7-20% HCl (see respondent's letter of 22 April 2014, page 10, diagram).

1.8.2 The Board remarks that the respondent has not raised any further Article 83 EPC objection with respect to the invention of claim 1 of auxiliary request 1. Taking account of the conclusion in point 1.8.1 above the Board considers that the invention of claim 1 of auxiliary request 1 complies with Article 83 EPC.

*2. Admissibility of amendments (Articles 123(2) and (3) EPC)*

*Auxiliary request 1*

2.1 Claim 1 of auxiliary request 1 is based on a combination of the claims 1, 15 and 21 of the patent as granted which are based on claims 15 and 21 of the application as originally filed (corresponding to the published WO-A-00/52224). By incorporating the additional features relating to the further components of the deposition process gas composition and their concentration ranges and by specifying that a coating of TiCN is deposited (see point IX above) the scope of the subject-matter of claim 1 of auxiliary request 1

has been restricted compared to that of claim 1 of the patent as granted.

2.1.1 Claims 2 to 9 of auxiliary request 1 are based on the following claims of the patent as granted: claim 22; claim 23; a combination of claims 1, 8, 26 and 32; claims 37 and 43; claim 33; claims 34 and 45; claims 6, 13, 19, 24, 30, 35, 41 and 46; and claims 7, 14, 20, 25, 31, 36, 42 and 47; respectively. Claims 2 to 9 of auxiliary request 1 have also their basis in the following claims of the application as originally filed (corresponding to the published WO-A-00/52224): claim 22; claim 23; claims 26 and 32; claims 37 and 43; claim 33; claims 33 and 45; claims 24, 30, 35, 41 and 46; and claims 25, 31, 36, 42 and 47, respectively.

2.1.2 Consequently, the amendments made to the claims 1 to 9 of auxiliary request 1 do not contravene Article 123(2) and (3) EPC. Auxiliary request 1 is therefore considered not to be formally objectionable except for a typing error in claim 9 "The process described in claim**s** 8" which correctly should read "The process described in claim 8".

*3. Remittal to the department of first instance (Article 111(1) EPC)*

Since the Opposition Division has not yet dealt with the opposition grounds under Article 100(a) EPC, i.e. lack of novelty and lack of inventive step, the Board, in exercising its discretion provided under Article 111(1) EPC, decides to remit the case to the department of first instance for further prosecution.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance for further prosecution on the basis of auxiliary request 1.

The Registrar: The Chairman:

G. Nachtigall H. Meinders

Decision electronically authenticated