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**Datasheet for the decision
of 5 March 2024**

Case Number: T 0571/22 - 3.2.03

Application Number: 14866904.7

Publication Number: 2920337

IPC: C23C14/06, C23C14/22,
C23C28/00, C23C14/00,
C23C14/35, C23C28/04

Language of the proceedings: EN

Title of invention:

BILAYER CHROMIUM NITRIDE COATED ARTICLES AND RELATED METHODS

Patent Proprietor:

Vergason Technology Inc.

Opponent:

Motherson Innovations Company Limited

Headword:

Relevant legal provisions:

RPBA 2020 Art. 12(6)

EPC Art. 123(2), 83, 54(2), 56

Keyword:

Late-filed evidence - admitted in first-instance proceedings
(no) - circumstances of appeal case justify admittance (no) -
error in use of discretion at first instance (no) - should have
been submitted in first-instance proceedings (yes) - admitted
(no)

Amendments - allowable (yes) - disclosure in drawings

Sufficiency of disclosure - (yes) - support by the description
(yes)

Novelty - multiple selection - (yes)

Inventive step - (yes)

Decisions cited:

G 0010/91, G 0003/14, T 0170/87, T 0676/90, T 1776/18

Catchword:



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Case Number: T 0571/22 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 5 March 2024

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 3 January 2022
rejecting the opposition filed against European
patent No. 2920337 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman C. Herberhold
Members: B. Miller
N. Obrovski

Summary of Facts and Submissions

- I. European patent EP 2 920 337 B1 ("the patent") relates to a bilayer chromium nitride coated article.
- II. An opposition was filed against the patent on the grounds of Article 100(b) and (c) EPC and Article 100(a) EPC together with Articles 54 and 56 EPC. The opposition division concluded that none of the grounds for opposition under Article 100 EPC prejudiced the maintenance of the patent and rejected the opposition.

The decision was appealed by the opponent ("the appellant").

III. Evidence

- (a) The following documents were cited during the opposition proceedings:

- D1: WO 2011/075796 A1
D2: US 5,672,386
D3: US 6,346,327 B1
D4: US 2007/0291381 A1
D5: Donald M. Mattox, "Handbook of Physical Vapour Deposition (PVD) Processing", Chapter 7, 2010, pages 237-286
D6: H. Bartzsch et al., "Different pulse techniques for stationary reactive sputtering with double ring magnetron", Surface and Coatings Technology, 120-121, (1999), pages 723-727

D7: Brahim Tlili et al., "Hardness and scratch response of PVD multilayer coatings", 3ème Congrès International Conception et Modélisation des Systèmes Mécaniques, Tunisia, 2009
copy from HAL archives-ouvertes,
submitted 27 November 2013

(b) The following documents were cited for the first time in the statement setting out the grounds of appeal:

D5a: Donald M. Mattox, "Handbook of Physical Vapour Deposition (PVD) Processing", Chapter 12, 2010, pages 439-474

D8 W. Fang et al., "On the thermal expansion coefficients of thin films", Sensors and Actuators, 84, 2000, pages 310-314

D9 W. Fang et al., "Determining mean and gradient residual stresses in thin films using micromachined cantilevers", J. Micromech. Microeng., 6, 1996, pages 301-309

IV. At the end of the oral proceedings on 5 March 2024, the following requests were confirmed by the parties:

The appellant requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed (main request) or, alternatively, that the patent be maintained on the basis of one of auxiliary requests 1 to 13 as submitted with the reply to the statement of grounds of appeal.

V. Wording of the claims

Claim 1 as granted according to the main request reads as follows:

"An article comprising:
a substrate;
a first chromium nitride material layer located over the substrate and having a first thickness, a first uniform chromium concentration and a first uniform nitrogen concentration;
a second chromium nitride material layer located upon the first chromium nitride material layer and having a second thickness, a second progressively graded increasing chromium concentration and a second progressively graded decreasing nitrogen concentration;
wherein the first thickness is from 200 to 1000 nanometers; and
wherein the second thickness is from 100 to 150 nanometers."

Claim 9 as granted reads as follows:

"A method for fabricating an article comprising:

forming over a substrate a first chromium nitride material layer having a first thickness, a first uniform chromium concentration and a first uniform nitrogen concentration;
forming over the substrate and upon the first chromium nitride material layer a second chromium nitride material layer having a second thickness, a second progressively graded increasing chromium concentration and a second progressively graded decreasing nitrogen concentration;

wherein the first thickness is from 200 to 1000 nanometers;
and wherein the second thickness is from 100 to 150 nanometers."

The further auxiliary requests 1 to 13 are not discussed in the following. Their wording is therefore not relevant for the decision.

VI. The appellant's arguments, as far as they are relevant for this decision, can be summarised as follows.

(a) Admittance of D6 and D7

D7 had been filed within the time limit according to Rule 116(1) EPC. Hence, the opposition division had no discretion regarding the admittance of D7.

D7 was *prima facie* relevant, since it disclosed a Cr/CrN multilayered coating system and addressed the same problems of crack propagation as addressed by the patent. Hence, D7 should have been admitted for its *prima facie* relevance.

D7 was published in 2009 in connection with the "3ième Congrès International Conception et Modélisation des Systèmes Mécaniques CMSM 2009", as printed on D7.

(b) Admissibility of D5a, D8 and D9

D5a, D8 and D9 had been filed in response to the reasoning in the contested decision. D5a, D8 and D9 represented information about the importance of thermal expansion coefficients for stress gradients in layers. These documents were thus *prima facie* relevant and were to be admitted into the proceedings. Moreover, D5a was

a textbook reporting common general knowledge and therefore was always to be taken into account.

(c) Amendments

Figure 1 as filed had to be interpreted in the context of the overall disclosure of the application. A combination of claim 1, Figure 1 and the disclosure on pages 4 and 8 as filed did not support claim 1 as granted because the specifically claimed thickness of the first chromium nitride layer was only disclosed in connection with stoichiometric (1:1) CrN, and the specific thickness of the second chromium nitride layer was only disclosed in connection with a pure chromium material or a chromium-rich CrN material at the surface of the layer. This was confirmed by claims 3 and 5.

The omission of a definition of the Cr:N ratio in the first layer and the Cr concentration of the second layer corresponded to the definition of a negative feature.

Even if Figure 1 as filed was considered on its own, three selections were required to arrive at claim 1 as granted. Moreover, it was not allowable to generalise single aspects from a schematic figure.

Figure 1 as filed did not specify what was meant by the term "graded". The term "graded" did not provide the same level of information and detail as the features "a second progressively graded increasing chromium concentration" and "a second progressively graded decreasing nitrogen concentration" in claim 1 as granted.

In addition, Figure 1 as filed did not provide a basis for dependent claims 2, 4 and 6 to 8 because the features of the claims were simply not disclosed in Figure 1.

(d) Sufficiency of disclosure

The production of graded layers was dependent on special conditions that had to be met; however, the patent did not disclose the special conditions and the complex controls that were required to produce gradients in a controlled manner.

Claim 1 encompassed an endless number of possible articles, since the CrN layers were broadly defined, the substrate type was not defined at all and further additional layers could be present in the coated article in claim 1.

Document D5a confirmed the common general knowledge that residual film stress arose in coatings from differences in the thermal coefficient of expansion. In view of this common general knowledge it was clear that the information provided in the patent did not put the skilled person in a position to achieve the alleged technical effects, i.e. to achieve a coated article in which the individual coatings adhered sufficiently to the substrate. Moreover, the results listed in Table 3 demonstrated that not all embodiments of claim 1 achieved the claimed effect of crack resistance.

Claim 1 defined the invention based on the unclear features "progressively graded increasing chromium concentration" and "progressively graded decreasing nitrogen concentration". The preparation of an article

as vaguely defined in claim 1 placed an undue burden on the skilled person.

(e) Novelty with regard to D1

The patent did not exclude an embodiment in which the gradation was formed by two layers having a different CrN composition. Furthermore, the transition zone between two layers having a different composition could be regarded as a graded layer. Claim 1 thus encompassed articles comprising a CrN / CrN or CrN / CrN / Cr layer stack, wherein the CrN layers had different compositions.

The claims of D1 disclosed an article comprising such a layered system (intermediate zone = CrN; reflective layer = CrN; cap layer = Cr). Moreover, the thicknesses of the layers as defined in claim 1 were disclosed in the claims of D1 as well.

Multiple selections within the disclosure of D1 were not required, since

- CrN was used in all examples,
- a cap layer of Cr was self-evident to reach the required bright reflectivity and
- the end points of the thickness ranges disclosed in D1 fell within the ranges defined in claim 1.

Moreover, Example 4 of D1 also disclosed a "graded" layer system since the Cr concentration in the outer layer (chromium cap layer) was higher than in the layer below (chromium nitride reflective layer).

(f) Novelty with regard to D2

D2 disclosed a coated article comprising a graded CrN layer. During the manufacturing process in D2 a uniform

CrN layer was inherently formed. D2 did not explicitly disclose specific thickness values for the CrN layers; however, D2 at least implicitly disclosed any thickness values, including values within the ranges defined in claim 1. According to the patent the thicknesses of the individual CrN layers had no specific effect.

(g) Inventive step starting from D1

All the examples in D1 made use of a reflective layer of chromium nitride. This gave the skilled person a clear hint that this layer material was particularly preferred. The use of a chromium cap layer was self-evident when the aim was a coated article having a chromium-like bright reflectivity. No effect had been demonstrated in the patent which was linked to the thickness of the layers defined by claim 1. Therefore, the thickness of the layers was totally irrelevant for assessing inventive step.

The subject-matter of claims 1 and 9 differed from D1 only on account of the progressive grading of the second layer. There was no evidence in the patent that this distinction solved any technical problem, at least over the whole scope of protection.

As no problem was solved by the claimed subject-matter of the patent, there could be no inventive step.

Alternatively, the problem to be solved could be formulated as that of providing an alternative article.

Graded CrN layers were well known in the art, as evidenced by D2 or D4. The skilled person was aware from D4 that graded layers were beneficial for

achieving better pinhole reduction and abrasion resistance.

Therefore, an inventive step was not present.

(h) Inventive step starting from D2

The subject-matter of the claims as granted differed from D2 only on account of the specific thickness of the layers as defined in claims 1 and 9.

The objective technical problem to be solved could be considered that of providing alternative articles.

Adapting the thickness of the layers in D2 to provide alternative articles did not involve an inventive step.

(i) Inventive step starting from D4

D4 disclosed mirrors for use in automotive and projection televisions (PTV) comprising a glass substrate, a reflective layer of chromium nitride and a further chromium layer.

Starting from D4 the underlying objective problem could be seen as to provide an alternative.

By combining the teaching of embodiments 1 and 2 of D4 the skilled person would solve this problem in an obvious manner.

VII. The respondent's counter-arguments to each of the above points can be summarised as follows.

(a) Admittance of D6 and D7

Documents D6 and D7 had not been admitted by the opposition division by exercising its discretion in an appropriate manner based on the correct criterion of *prima facie* relevance.

D7 was no more relevant than D2 or D4, since D2 and D4 also already demonstrated that graded CrN layers were known in the art on the priority date of the patent.

Doubts arose as to whether D7 was available on the priority date of the patent. D7 was a paper based on a presentation at a conference in Tunisia in 2009. No proof had been provided regarding the content which had been presented during the conference. The paper itself (D7) had been submitted to the HAL archives only one week before the priority date of the patent; however, no evidence had been provided of when the paper was made available to the public.

(b) Admittance of D5a, D8 and D9

D5a increased the volume of the case. It was also not relevant for a review of the decision under appeal. D8 and D9 should have been filed in opposition proceedings. They were also no more relevant than the documents cited during the opposition proceedings.

(c) Amendments

Claim 1 as filed specified that the first and second layer had a first and a second thickness. These

generally addressed first and second thicknesses had been further specified by the only specific thickness ranges disclosed in the application as filed. It was immediately apparent from the application as filed that the thickness was independent of a specific Cr:N ratio in the first layer or a specific chromium concentration in the second layer, in particular in view of page 4, lines 7 to 11 and 15 to 17 and page 8, lines 6 to 14 of the specification or Figure 1 as filed.

(d) Sufficiency of disclosure

For sufficiency of disclosure, the patent had to be considered as a whole. The patent disclosed detailed examples of how to obtain articles according to the invention. Moreover, the patent also disclosed which types of substrates could be used.

The invention belonged to a well-established and well-known field. The skilled person was familiar with the methods for applying a Cr-containing layer by sputtering.

Based on the common general knowledge, the skilled person did not encounter any problems with achieving a coated article in which the individual coatings adhered sufficiently to the substrate.

This was also confirmed by the experimental evidence as summarised in Table 1 of the patent. Whether or not the coating remained intact under severe conditions for a specific time span as reported in the further tables of the patent was not relevant for the invention as defined by claim 1.

Claim 1 did not define the invention in unclear terms. The expression "a second progressively graded increasing chromium concentration and a second progressively graded decreasing nitrogen concentration" was readily understood by the skilled person, in particular when taking into account paragraph [0027] of the specification.

(e) Novelty with regard to D1

None of the examples in D1 disclosed an article comprising two different CrN layers according to claim 1.

The claims of D1 defined a coated article in which various options were possible. Starting from claim 13 multiple selections were required to arrive at an article comprising a CrN / CrN or CrN / CrN / Cr layer stack; however, even when making multiple selections within the general disclosure provided by the claims of D1, D1 did not disclose an article according to claim 1. An arrangement of two CrN layers having different compositions did not form a progressively graded layer as defined by claim 1 of the patent. A progressively graded layer required a change in the concentration over the entire thickness of the layer. This literal meaning was confirmed by the explanations in paragraph [0027] of the patent. Moreover, a possible transition zone between two layers having different compositions did not meet the thickness requirement in claim 1.

(f) Novelty with regard to D2

D2 did not disclose a uniform CrN layer. Even when assuming that a uniform layer was formed inherently at

the beginning of the manufacturing process set out in D2, D2 did not disclose the specific thickness values for the CrN layers.

(g) Inventive step starting from D1

Starting from the disclosure of the claims of D1, the skilled person was not motivated to select the materials for the intermediate, reflective and cap layers and their thicknesses according to claim 1 of the patent in order to obtain an article having similar reflectivity and inhibited crack susceptibility in comparison with a related article that utilises only a chromium-containing coating.

Furthermore, no hint was provided by D1 to consider documents such as D2 or D4 or to use a graded CrN-layer described in these documents in the multilayered coating in D1 to obtain an article with those properties.

(h) Inventive step starting from D2

D2 was directed to an article comprising a graded CrN layer. Starting from D2 the skilled person was not motivated to adapt the article in D2 by additionally applying a uniform CrN layer in the thickness as defined in claim 1, and additionally to apply the graded CrN layer in a thickness as defined in claim 1 in order to provide an article having similar reflectivity and inhibited crack susceptibility in comparison with a related article that utilises only a chromium-containing coating.

(i) Inventive step starting from D4

The skilled person had no motivation to combine the individual and separate embodiments of D4 and at the same time to change the thickness of the CrN_x layer.

Hence, the subject-matter of claim 1 was not obvious in view of D4.

Reasons for the Decision

1. Admittance of documents D6 and D7

1.1 The opposition division decided not to admit documents D6 and D7 into the opposition proceedings, since these documents had been filed late, i.e. after the nine-month opposition period, and were not considered to be *prima facie* relevant.

Documents D6 and D7 were re-filed with the statement setting out the grounds of appeal.

1.2 According to Article 12(6), first sentence, RPBA the Board will not admit requests, facts, objections or evidence which were not admitted in the proceedings leading to the decision under appeal, unless the decision not to admit them suffered from an error in the use of discretion or unless the circumstances of the appeal case justify their admittance.

1.3 The appellant argued that the decision not to admit D6 and D7 suffered from an error in the use of discretion. According to the appellant the opposition division did

not have any discretion whatsoever over the admittance of D6 and D7 because these documents had been filed within the time limit according to Rule 116(1) EPC.

This argument is unfounded.

- 1.3.1 Under Article 114(2) EPC, the EPO may disregard facts or evidence which are not submitted in due time by the parties concerned. The requirement for a submission not to have been "submitted in due time" is thus a precondition for exercising discretion under this provision.

In this case, whether or not the opposition division had discretion not to admit D6 and D7 thus depends on whether these documents were filed "in due time" within the meaning of Article 114(2) EPC.

- 1.3.2 According to Article 99(1) EPC in conjunction with Rule 76(2) (c) EPC opponents have to file, within the nine-month opposition period, a statement of the grounds on which the opposition is based, as well as an indication of the facts and evidence presented in support of these grounds.

This Board endorses the approach according to which the end of the opposition period under Article 99(1) EPC is a fixed point in time as of which an opposition division has discretion not to admit facts and evidence submitted by an opponent (see T 1776/18, point 4.6.4 of the Reasons, with further references).

Accordingly, an opposition division has discretion not to admit facts and evidence which are not filed within the nine-month opposition period.

In this case, documents D6 and D7 were not filed within that period. Hence, the opposition division had discretion under Article 114(2) EPC not to admit these documents.

- 1.3.3 The Board further notes that, contrary to the appellant's view, a communication under Rule 116(1) EPC by an opposition division is not an invitation to file new submissions (see Case Law, Chapter IV.C.4.3.2.).
- 1.4 When exercising its discretion, the opposition division considered the *prima facie* relevance of documents D6 and D7; see page 12, third paragraph of the contested decision and point 10 of the minutes of the oral proceedings before the opposition division. The opposition division thus applied an appropriate criterion for the exercise of its discretion (see Case Law of the Boards of Appeal, 2022, 10th edition, Chapter IV.C.4.5.3.a).
- 1.5 In conclusion, the opposition division had discretion not to admit documents D6 and D7 and applied the correct criteria. Its decision not to admit these documents therefore does not suffer from an error in the use of discretion within the meaning of Article 12(6), first sentence, RPBA.
- 1.6 The circumstances of the appeal case as referred to in Article 12(6), first sentence, RPBA do not justify the admittance of documents D6 and D7 into the appeal proceedings either. In particular, the circumstances of the appeal case, including the claim requests under consideration, did not change such that the *prima facie* relevance of documents D6 and D7 would have to be assessed differently from in the opposition proceedings. In fact, the main request in the appeal

proceedings, i.e. the patent as granted, is identical to the main request in the opposition proceedings.

1.7 For completeness, in the following the Board addresses the additional submissions made by the appellant regarding the alleged *prima facie* relevance of document D7 in the appeal proceedings. Concerning document D6, the appellant presented no arguments other than the fact that the opposition division allegedly did not have any discretion.

1.7.1 Concerning D7, the appellant argued that, similarly to D2 and D4, D7 disclosed that graded CrN layers and their influence on the crack resistance of CrN multilayered coatings were known in the art.

As evident from the appellant's arguments, documents D2 and D4 provide technical teaching which is similar to D7. Moreover, the knowledge of the existence and effects of graded CrN layers as also disclosed in D7 is not decisive for the assessment of inventive step (see below). Hence, the disclosure in D7 is no more relevant than the content of the remaining documents on file.

Furthermore, it has not even been established that D7 constitutes prior art under Article 54(2) EPC.

D7 is a paper which is based on a presentation given during a conference, the "3ème Congrès International Conception et Modélisation des Systèmes Mécaniques, Tunisia, 2009", as indicated on page 1 under the heading "To cite this version".

However, no proof has been provided regarding the content of the actual presentation taking place during the conference in 2009. Hence, it cannot be concluded

that the exact and full content of D7 was made available during the conference in 2009.

D7 also indicates on page 1 that the paper was submitted to HAL archives on 27 November 2013. This date is very close to the priority date of the patent of 4 December 2013, and the date of submitting a document to an archive is not necessarily the date on which the submitted article was made accessible to a member of the public. The links on page 2 of D7 to certain websites are not proof of publication in 2009, either, since it has not been established that the linked documents are identical to D7 and had already been published in 2009.

- 1.8 In summary, D7 is not *prima facie* relevant for this case since its publication date has not been proven and its content is no more relevant than the content of the remaining documents on file.
- 1.9 Therefore, the Board decided not to admit documents D6 and D7 into the appeal proceedings (Article 12(6), first sentence, RPBA).
2. Admittance of documents D8 and D9
 - 2.1 Documents D8 and D9 have been filed for the first time in the appeal proceedings together with the statement setting out the grounds of appeal.

Under Article 12(6), second sentence, RPBA, evidence or objections which should have been submitted in the proceedings leading to the decision under appeal will not be admitted unless the circumstances of the appeal case justify their admittance.

- 2.2 The appellant has not explained why it had not already submitted D8 and D9 during the opposition proceedings.

In the annex to the summons to attend oral proceedings the opposition division had already expressed its view that none of the grounds of opposition prejudiced the maintenance of the patent as granted. Hence, the appellant had a clear incentive to supplement its objections even at that point in time.

The appellant thus should have already submitted all necessary documents in support of its objection under Article 100(b) EPC (paragraphs [0039] and [0040] of the statement setting out the grounds of appeal) and an appropriately substantiated objection in the opposition proceedings.

It follows that the course of the opposition proceedings does not provide justification for only filing D8 and D9 in the appeal proceedings.

- 2.3 Therefore, the board decided not to admit documents D8 and D9 into the appeal proceedings (Article 12(6), second sentence, RPBA).

3. Admittance of document D5a

- 3.1 Document D5a has been filed for the first time together with the statement setting out the grounds of appeal. Its admittance is thus subject to the Board's discretion under Article 12(2) and (4) RPBA.

- 3.2 As acknowledged by all parties, document D5a is a copy of pages of a textbook and illustrates common general knowledge. In view of its *prima facie* relevance for the

decision to be taken, the Board decided to admit this document into the appeal proceedings (Article 12(4) RPBA).

4. Article 100(c) EPC

4.1 Claim 1 as granted is based on claim 1 as filed, wherein the first thickness of the first chromium nitride material layer and the second thickness of the second chromium nitride material layer have been specified in greater detail by adding the following features:

"wherein the first thickness is from 200 to 1000 nanometers; and wherein the second thickness is from 100 to 150 nanometers."

4.2 The specific thickness ranges of the first and second CrN layer are disclosed in general terms in Figure 1 of the application as originally filed (references in this regard refer to the application as published, WO 2015/084419 A1, "the application"):

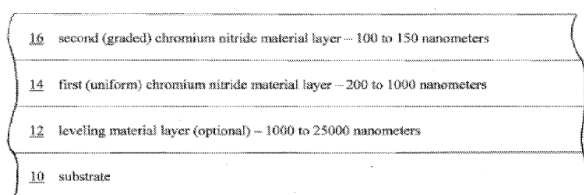


FIG. 1

The article illustrated by the schematic drawing of Figure 1 of the application corresponds to the article defined in claim 1 as filed.

The disclosure of Figure 1 of the application is unrelated to any specific limitations concerning the composition of the first uniform and the second graded

chromium nitride material layer and is not limited by the presence of a levelling material layer (this layer being explicitly labelled as "optional" in Figure 1).

Hence, the general teaching in Figure 1 of the application provides a direct and unambiguous basis for the amendments in claim 1.

- 4.3 The appellant argued that the disclosure of Figure 1 had to be considered in the context of the application as a whole, in particular in the context of claims 3 and 5 and the disclosure on pages 4 and 8 of the application.

This argument is not convincing.

Figure 1 as filed is a schematic representation of the layered article in claim 1 as filed as a whole, in which the thickness ranges have been disclosed *expressis verbis*. Figure 1 therefore corresponds to claim 1 as filed except for the fact that the vague expressions "first thickness" and "second thickness" are specified in greater detail by specific thickness ranges.

Although claims 3 and 5 as originally filed disclose the thickness ranges together with further features (the first uniform chromium concentration and the first uniform nitrogen concentration provide an atomic ratio of about 1:1; the second progressively graded increasing chromium concentration and the second progressively graded decreasing nitrogen concentration result in a comparatively chromium-rich nitride material or in a pure chromium material at the exposed surface of the second chromium nitride material layer),

the application as a whole does not disclose that the thicknesses of the first and second CrN layers have to fall within the defined ranges under specific conditions only, i.e. only when these further limitations concerning the composition of the CrN layers are fulfilled.

Figure 1 itself does not teach a link between the thickness ranges disclosed in this figure and the composition of the first and second CrN layers. In addition, the accompanying description of Figure 1 does not imply that there is a functional relationship between the thickness ranges and the composition of the layers. The description referring to Figure 1 and placing Figure 1 into the general technical context of the application instead states exactly the opposite.

Concerning the first uniform CrN layer, the application discloses the following in the sentence bridging pages 7 and 8 with reference to Figure 1:

"As well, the first uniform chromium concentration and the first uniform nitrogen concentration are equal in atomic concentration and intended to provide a stoichiometric chromium nitride (i.e., CrN) material layer, **although the embodiments are also intended as operative when using non-stoichiometric chromium nitride materials as a starting point.**"

(Emphasis added by the Board.)

The last part of this sentence makes it clear that, in the context of Figure 1, it was not stipulated that the first CrN layer has a stoichiometric Cr:N ratio.

In similar terms, the application discloses the thickness of the second chromium nitride material in a

separate sentence in the first complete paragraph on page 8 without any further limitations:

"[...] Within the embodiments, the second chromium nitride material layer 16 has a second thickness, a second progressively increasing chromium concentration and a second progressively decreasing nitrogen concentration. **Within the context of the embodiments, the second thickness is from about 100 to about 150 nm.** As well, the second progressively increasing chromium concentration is intended **in a particular instance** to yield pure chromium for the last 10 nm to 20 nm of the second chromium nitride material layer. **In an alternative**, the second progressively increasing chromium concentration is intended in another particular instance to yield a chromium rich chromium nitride material at the last portion of the second chromium nitride material layer 16 [...]"
(Emphasis added by the Board.)

Following the sentence disclosing the thickness of the second chromium nitride material layer, the application describes further exemplary embodiments ("in a particular instance", "In an alternative"); however, these more specific embodiments do not imply any functional link or limitation to the previously stated thickness range.

Hence, in the context of the application as a whole Figure 1 provides an appropriate basis for the amendments to claim 1.

4.4 With reference to T 676/90, the appellant further argued that features of a schematic figure could not be considered out of context and could not be generalised.

This argument is not convincing.

T 676/90 confirms the established principle (see Case Law of the Boards of Appeal, 2022, 10th edition, Chapter II.E.1.13.1) also applied in this case whereby the technical teaching of the application as a whole has to be taken into account (see T 676/90, point 2.1 of the Reasons) and whereby the specific circumstances of a case have to be taken into account (see point 2.5 of the Reasons).

In T 676/90 the amendment in question was generalised from a technical drawing of a specific detail of a device. The case forming the basis for T 676/90 therefore differs fundamentally from this case, in which Figure 1 as filed is a schematic representation of the layered article in claim 1 as filed as a whole, wherein the thickness ranges have even been disclosed *expressis verbis*.

- 4.5 The appellant also argued that three selections were required within the disclosure of Figure 1 as filed (the three features indicated in brackets in Figure 1) to arrive at the subject-matter of claim 1 of the patent.

This argument is not persuasive.

Claim 1 as originally filed discloses an article comprising a graded and a uniform chromium nitride layer. Therefore, the two words indicated in brackets in Figure 1 ("graded" and "uniform") are not optional features to be selected from the general disclosure of Figure 1 when starting from claim 1 as filed. The only optional feature indicated in Figure 1 as filed is the levelling layer, which is explicitly

indicated to be "(optional)". Considering the disclosure of Figure 1 without the single feature being labelled as optional does not require multiple selections, but corresponds to the direct and unambiguous disclosure of Figure 1.

- 4.6 With reference to T 170/87, the appellant further argued that the amendment to claim 1 corresponded to the addition of a negative feature for which specific conditions had to be fulfilled in order to be allowable.

However, as indicated above, the amendments to claim 1 correspond not only to the isolated information provided by Figure 1, but also to the teaching of the specification in relation to Figure 1. For this reason alone, this further argument by the appellant is not convincing.

Moreover, claim 1 as filed has been amended by adding specific thickness ranges for the "first thickness" and the "second thickness". The added thickness ranges are limitations imposed by further positive restrictions. Claim 1 does not contain any negative features, such as disclaimers which exclude subject-matter from the patent protection conferred by a claim. Hence, the principles summarised in the Case Law of the Boards of Appeal, 2022, 10th edition, Chapter II.E.1.13.3 in relation to amendments using negative features such as disclaimers (in the case of T 170/87: "with no internal fittings") are not applicable in this case.

- 4.7 The appellant argued that Figure 1 did not provide a general disclosure of the various thicknesses since the second chromium nitride material layer was defined as being "graded" without the meaning of the term "graded"

in the context of Figure 1 being specified. Claim 1 referred to a "progressively graded" layer, contrary to a "graded" layer according to the Figure 1. Hence, Figure 1 and claim 1 of the application referred to different types of graded layers.

This argument is not persuasive either.

The question of whether the expression "progressively graded" in claim 1 as filed is clear to a skilled person relates to the assessment of clarity and is not relevant for the assessment of the allowability of the amendments to that claim. The Board observes that according to G 3/14 the clarity of the expression "progressively graded" in claim 1 as granted is not open for discussion in these appeal proceedings.

With regard to the interpretation of the term "graded" in Figure 1 of the application, the Board considers that, even if the meaning of this term were unclear to the skilled person, the skilled person would interpret it in the context of the teaching of the application as a whole, i.e. also in the context of the remaining description and, in particular, claim 1 as filed.

Claim 1 as filed defines the presence of a "gradually graded" second layer, which provides the context in which the term "graded" in Figure 1 as filed has to be considered. There is no reason to assume that Figure 1 uses the term "graded" in a different context and with a different meaning than claim 1 as filed. Moreover, the technical teaching provided by Figure 1 concerning the thickness of the chromium nitride material layers is not dependent on the specific interpretation of the term "graded".

4.8 The dependent claims have not been amended compared with the claims as originally filed. By analogy with claim 1, they are based on the disclosure of the claims as originally filed in combination with the teaching of Figure 1 as filed.

4.9 The Board therefore concludes that the ground of opposition pursuant to Article 100(c) EPC does not prejudice the maintenance of the patent as granted.

5. Article 100(b) EPC

5.1 According to Article 83 EPC and established case law of the Boards of Appeal, the patent specification as a whole, and not claim 1 as such, must convey reworkable teaching for the skilled person (Case Law of the Boards of Appeal, 10th edition, 2022, Chapter II.C.3.1).

Paragraphs [0015] and [0016] of the patent confirm that the CrN coating of claim 1 can be applied by PVD, in particular by magnetron sputtering.

Since PVD coating methods are well known in the art as being suitable for various substrates and for applying chromium nitride layers, there is no reason why the skilled person would be unable to form CrN layers on a substrate according to claim 1, in particular when taking into account the general teaching of the patent.

Moreover, paragraphs [0027]-[0028] of the patent disclose, in detail, a manufacturing process for obtaining articles according to claim 1. Contrary to the appellant's view, the patent thus gives the skilled person clear guidance, by way of a specific exemplified

manufacturing process, as to how a coated article according to claim 1 can be obtained.

The patent therefore provides sufficient information for the skilled person to rework the invention.

- 5.2 The appellant argued that the skilled person was faced with an undue burden since claim 1 encompassed an endless number of possible articles because
- the features of claim 1 were broadly defined,
 - the substrate type was not defined at all,
 - the composition of the CrN layers was not defined,
- and
- the number of layers was not limited in claim 1.
- According to the appellant it was common knowledge that the nature of the substrate, the composition of the coating layers and the composition of further layers would influence the properties of the coating, in particular its adherence to the substrate, as evidenced by D5a, by way of example (see page 446, heading: "Residual Film Stress").

This argument is not convincing.

- 5.2.1 A successful objection of lack of sufficiency of disclosure presupposes that there are serious doubts, substantiated by verifiable facts (Case Law of the Boards of Appeal, 10th edition, 2022, Chapter II.C.9.). The mere fact that a claim is broadly defined does not constitute a reason to assume that the patent does not fulfil the requirement of sufficient disclosure. The appellant has not provided any evidence which could cast doubt on the fact that the examples in the patent could be reworked or that the skilled person would face an undue burden when using conventional sputtering methods to coat conventional substrates such as

polycarbonate in order to obtain an article according to claim 1.

- 5.2.2 Claim 1 does not define the invention by making reference to a specific effect or corresponding parameter. Whether the chromium nitride coating of any article according to claim 1 achieves the properties reported in Table 3 of the patent or a specific absolute crack resistance is not relevant for the question of whether the skilled person is able to obtain an article according to claim 1. In order to obtain an article of the invention the skilled person simply has to be able to deposit two chromium nitride material layers on a substrate. This is clearly the case, since the skilled person is aware of PVD coating techniques and magnetron sputtering.
- 5.2.3 Even when considering the well-known fact that a CrN coating may have different adherence properties on different substrates, it does not follow that the skilled person is faced with an undue burden in order to produce a coated article according to claim 1. Since it is known to the skilled person to which substrate a chromium coating can be applied and which properties it has on this substrate, the skilled person would take this knowledge into account when reworking the invention of the patent. Moreover, regarding the selection of suitable substrate materials, the skilled person can rely on the possible types of substrate disclosed in paragraphs [0022], [0028] and [0039] of the patent.
- 5.2.4 The skilled person is aware of adhesion problems deriving from residual film stress arising from differences in the thermal coefficient of expansion, such as those summarised on page 446 of D5a; however,

even taking this general knowledge into account, it does not follow that the skilled person would be unable to obtain an article according to claim 1. On the contrary, considering the common general knowledge the skilled person would not be tempted to coat any type of material with chromium, but would use the commonly known coating techniques on commonly used substrates.

- 5.2.5 Further additional intra-coating layers, including a levelling layer, can have a significant effect on the resulting physical properties of the overall coating, e.g. due to different thermal expansion coefficients of the coating materials, as stated by the appellant.

However, this is also known to the skilled person. Hence, a skilled person would not expect to be able to apply a CrN coating to an incompatible layer or to achieve a CrN coating that always has the same properties irrespective of the presence of further intra-coating layers.

Therefore, the possible presence of further layers in the article as defined in claim 1 does not result in an undue burden for the skilled person in order to manufacture an article according to claim 1.

- 5.3 The appellant further argued that the preparation of layers as defined in claim 1 further placed an undue burden on the skilled person, since claim 1 defined the invention based on ill-defined features: "progressively graded increasing chromium concentration" and "progressively graded decreasing nitrogen concentration".

This argument is not convincing either.

5.3.1 According to established case law, the skilled person should try, with synthetical propensity, i.e. building up rather than tearing down, to arrive at an interpretation of the claim which is technically sensible and takes into account the whole disclosure of the patent. The patent must be construed by a mind willing to understand, not a mind desirous of misunderstanding; see Case Law of the Boards of Appeal, 10th edition, 2022, Chapter II.6.1.

Even if a skilled person had doubts over the meaning of the features "progressively graded increasing chromium concentration" and "progressively graded decreasing nitrogen concentration" when considered in isolation, it would become clear just from the wording of the other features in claim 1 that these features relate to a "second chromium nitride material layer" having a concentration gradient in contrast to the further "first chromium nitride material layer", which has a uniform chromium and nitrogen concentration.

When reading claim 1 with the required willingness to understand, the skilled person thus has no problem determining the meaning of claim 1 and manufacturing an article according to claim 1 without undue burden.

5.3.2 Even if the skilled person had doubts over determining the meaning of the features based on the teaching of claim 1 as argued by the appellant, the skilled person easily derives from the accompanying specification (see paragraphs [0014] and [0027]) what is meant by the features of claim 1 and how to achieve them by varying e.g. the concentration of nitrogen in the process chamber in order to gradually change the concentration of nitrogen in the coating.

Hence, the expressions in claim 1 do not prevent the skilled person from reworking the invention using routine experimentation.

5.4 In view of the above, the Board concludes that the ground of opposition pursuant to Article 100(b) EPC does not prejudice the maintenance of the patent as granted.

6. Article 100(a)/54 EPC

6.1 D1

6.1.1 D1 discloses, in claims 1, 5, 7, 8 and 9, 10 to 13, a plastic mirror comprising

- a plastic substrate,
- a hard coating,
- a reflective layer having a thickness of 20 nm to 80 nm,
- an intermediate zone between the hard coating and the reflective layer wherein the intermediate zone having a thickness in the range of 100 nm to 200 nm and
- a cap layer on the reflective layer having a thickness of 5 nm to 40 nm.

The appellant argued that, in view of the underlying problem of D1 (plastic mirror) and the teaching provided by the examples in D1 (all examples comprise a reflective layer of CrN), the disclosure of the claims of D1 would be interpreted as disclosing an article according to claim 1 of the patent.

This argument is not convincing.

- 6.1.2 Starting from the generic disclosure presented by the claims of D1, the following multiple selections are required when following the appellant's argument:
- intermediate layer
 - selection of Cr and selection of nitride in claim 5, selection of upper thickness limit of 200 nm in claim 6
 - reflective layer
 - selection of Cr, selection of nitride in claim 8 or 9, selection of upper thickness limit of 80 nm in claim 10
 - cap layer
 - selection of Cr, selection of upper thickness limit of 25 nm or 40 nm in claim 13.

This does not amount to a direct and unambiguous disclosure of an article according to claim 1; see Case Law of the Boards of Appeal, 10th edition, 2022, Chapter I.C.6.3.3.

- 6.1.3 The examples in D1 all comprise a reflective layer of CrN. Even if, in line with the appellant's argument, the overall disclosure of the examples in D1 implies that CrN is a preferred option for the reflective layer, the selection of CrN as the material for the reflective layer is still one of several selections required within the disclosure of the claims of D1 in order to arrive at subject-matter which, according to the appellant, would be disclosed in D1.

- 6.1.4 Even if the multiple selections are made, the subject-matter of claim 1 nevertheless differs from the disclosure of D1 on account of the presence of a CrN layer with a "progressively graded increasing chromium concentration and a second progressively graded decreasing nitrogen concentration".

According to its literal meaning, which is confirmed by the corresponding teaching of the patent (see paragraph [0027], manufacturing step E: "gradient transition layer ramping, or short steps from a pure chromium nitride material to a pure chromium material" or bullet point 4: "a gradient layer can either be linear transition from 100% nitrogen to 100% argon or transition with sequential short steps"), a progressively graded layer requires the composition of the layer to change over the whole thickness of the layer in a plurality of steps or continuously.

In contrast to this, a layered arrangement of two individual layers (two CrN layers or a combination of CrN and Cr) as selectable from the options disclosed in the claims of D1 exhibits a single, abrupt change in composition (see also last sentence of paragraph [0014] of the patent).

Hence, a two-layered arrangement as selectable from the disclosure in D1 does not result in an arrangement in which a layer is "progressively graded".

The appellant argued that the transition zone between two CrN layers could possibly be regarded as a graded layer.

However, D1 does not disclose the thickness for such an allegedly forming transition zone between two selectable CrN layers. Hence, this line of argument also does not lead to the conclusion that multiple selections within the disclosure of D1 could result in subject-matter according to claim 1 of the patent.

6.1.5 The further passages cited in the description of D1 (see, for example, for the intermediate layer: page 14, line 30 to page 15, line 20, for the reflective layer: page 16, lines 4 to 9, for the cap layer: page 16, line 27 to page 17, line 7) do not change this assessment of the claims of D1, since the cited passages in the description are also as generic as the corresponding claims. For example, according to the paragraph bridging pages 14 and 15 and the paragraph bridging pages 15 and 16 of D1, chromium nitride is only one material combination of various possible selectable options to be used in the intermediate and reflective layers according to D1. Hence, starting from the general disclosure of D1, the same multiple selections are required as those in the claims of D1.

Furthermore, a progressively graded CrN layer is not disclosed in the general specification of D1 either.

6.1.6 The appellant argued in writing that Example 4 of D1 disclosed a graded layer system in which the two outer layers both were made from CrN, wherein the Cr concentration in the outer layer was higher than in the layer below.

Example 4 of D1 discloses a coating with a CrN layer (reflective layer) having a thickness of 40 nm and a chromium cap layer having a thickness of 10 nm.

The subject-matter of claim 1 differs from this Example 4 just for the reason that the two layers of CrN have a thickness as defined in claim 1. Moreover, the coated article in Example 4 does not comprise a graded CrN layer as defined in claim 1 as discussed above.

6.1.7 Both parties agree that the arguments regarding claim 1 apply in the same manner to the subject-matter of claim 9.

6.1.8 It can therefore be concluded that the subject-matter of claims 1 and 9 as granted is novel over D1.

6.2 D2

6.2.1 D2 discloses a wear-resistant coating on a sliding part subjected to severe conditions, such as a piston ring. The substrate can be coated first with a layer of chromium not containing nitrogen to avoid adherence problems (see column 2, lines 27 to 39 of D2). A chromium nitride layer is applied to this chromium layer; see column 2, lines 33 to 35.

According to the example in D2, a stainless-steel substrate is coated with chromium nitride to provide a coating in which the content of chromium is lower adjacent to the substrate surface and increases as it approaches the surface; see column 3, lines 17 to 20. Figure 3 demonstrates that the composition of the graded chromium nitride layer varies progressively from $\text{CrN} \rightarrow \text{CrN}+\text{Cr}_2\text{N} \rightarrow \text{Cr}_2\text{N}+\text{Cr} \rightarrow \text{Cr}$.

The graded chromium nitride layer is obtained according to D2 by reducing the nitrogen gas in the process chamber to zero over 20 minutes; see column 3, lines 3 to 5.

6.2.2 At the start of the deposition process in D2 (see column 2, line 63 to column 3, line 3), chromium is vaporised and the partial pressure of the nitrogen is brought to 2×10^{-3} Torr by introducing the nitrogen gas from the introducing pipe, and vapour deposition is

performed by opening a shutter. Such conditions are maintained for two minutes.

The appellant argued that, following the process steps according to D2, a further uniform layer of chromium nitride is implicitly obtained in addition to the graded CrN layer.

However, no experimental proof has been provided by the appellant to support this allegation. Moreover, a uniform layer is not shown in Figure 3 of D2 either.

6.2.3 Even when accepting, for the sake of argument, that a uniform CrN layer is formed at the start of the manufacturing process in D2 in line with the appellant's argument, the substrate in D2 is coated with a uniform CrN layer, a graded CrN layer and a final Cr layer.

However, as also acknowledged by the appellant, D2 does not disclose the thickness of the individual layers, as required by claim 1 of the patent.

6.2.4 The appellant argued that D2 described the sputtering process in general terms and hence the skilled person would derive from D2 that layers of conventional thickness were obtained by D2, which encompassed the thickness ranges defined in claim 1.

This argument is not convincing.

The appellant has not provided any evidence for its mere allegations that the two allegedly formed CrN layers in D2 have conventional thicknesses and that these alleged conventional thicknesses fall within the

individual thickness ranges defined in claim 1 of the patent.

In view of the disclosure in D2, this is not even likely. D2 is clearly directed to a graded CrN layer; see column 1, lines 57 to 65. Moreover, the results demonstrated in Figure 3 of D2 do not show a substantial amount of a uniform CrN layer. D2 does not provide a disclosure from which it could be directly and unambiguously derived that a further uniform CrN layer is inherently obtained which has an even greater thickness than the graded CrN layer which D2 aims to obtain (which would be required to fulfil the requirements of claim 1).

Hence, the appellant's argument is based on mere allegations and therefore is not convincing.

6.2.5 Furthermore, according to established case law a parameter range is only considered to be known when specific values falling within the range are disclosed in the prior art. A more generic disclosure (no thickness values disclosed in D2) does not take away the novelty of a specific defined range as defined in claim 1, contrary to the appellant's argument (see Case Law of the Boards of Appeal, 10th edition, 2022, Chapter I.C.5.2.6 and I.C.6.3.1). In the case of multiple parameter ranges, as in this case, values for all the parameter ranges have to be disclosed in combination in a document in order to challenge the novelty of the claimed parameter ranges; see Case Law, Chapter I.C.6.3.3. This is clearly not the case with regard to D2.

6.2.6 It follows that the subject-matter of claims 1 and 9 differs from the disclosure in D2 in that the coated articles comprises

- a first chromium nitride material layer having a uniform chromium concentration having a thickness from 200 nm to 1000 nm; and
- that the thickness of the (second) chromium nitride material layer having a graded chromium concentration is from 100 nm to 150 nm.

6.3 In view of the above, the Board concludes that the ground of opposition pursuant to Article 100(a) EPC in combination with Article 54 EPC does not prejudice the maintenance of the patent as granted.

7. Article 100(a)/56 EPC

7.1 Starting from D1

7.1.1 The contested patent is directed to an article comprising a chromium nitride coating (see claim 1 and paragraph [0003]) which is crack-resistant and at the same time brightly reflective (see paragraph [0015]).

A skilled person aiming to obtain a crack-resistant chromium nitride coated article could start from D1, since D1 is also directed to mirrors and addresses stress-induced cracking of coated articles (see page 5, last paragraph).

7.1.2 The appellant argued that the skilled person would consider the overall disclosure of D1 as the starting point for further development. In its view the subject-matter of claim 1 differed from the generic disclosure of D1 only on account of the progressive grading of the

second layer, for which the patent did not credibly demonstrate that it was responsible for obtaining a crack-resistant article over the whole scope of protection. In the absence of a technical problem solved by the claimed article it could not be considered inventive. An article according to claim 1 of the patent would be an obvious alternative to the article disclosed in D1.

This argument is not convincing.

- 7.1.3 Even though the overall teaching of a prior-art document has to be taken into account, as argued by the appellant, it is still necessary to identify the specific disclosure of a prior-art document in order to identify the distinguishing features with regard to the closest prior art.

When starting from the generic disclosure presented by the claims of D1 (and the corresponding relevant paragraphs bridging pages 14-15 and 15-16 of the specification), contrary to the appellant's argument, the subject-matter of claim 1 not only differs on account of the progressive grading of the second layer, but instead it is also necessary to make various selections in addition, as discussed above in detail regarding novelty

- (intermediate layer: selection of Cr, selection of nitride in claim 5, selection of upper thickness limit of 200 nm in claim 6;
- reflective layer: selection of Cr, selection of nitride in claim 8 or 9, selection of upper thickness limit of 80 nm in claim 10;
- cap layer: selection of Cr, selection of upper thickness limit of 25 nm or 40 nm in claim 13).

7.1.4 The article in claim 1 solves the technical problem of obtaining an article with "similar reflectivity and inhibited crack susceptibility in comparison with a related article that utilizes only a chromium containing coating"; see paragraph [0006] of the patent.

Hence, contrary to the appellant's argument, the article serves a purpose and solves a technical problem.

D1 does not motivate or prompt the skilled person to make the various selections and modifications listed above to solve the underlying technical problem derivable from paragraph [0006] of the patent.

7.1.5 Even if it were to be concluded, for the sake of appellant's argument, that this problem would not be solved over the whole scope of protection, it nevertheless would not directly follow that the claimed subject-matter is not inventive.

Instead, it would be necessary, in line with established case law, to define a less ambitious problem (see Case Law of the Boards of Appeal, 10th edition, 2022, Chapter I.D.4.4.1) and to accordingly evaluate the obviousness of its solution.

7.1.6 The appellant argued that the objective technical problem starting from D1 could be formulated as that of providing an alternative article.

Even if this less ambitious problem is considered for the sake of argument, the skilled person would not be motivated to combine preferred and non-preferred options within the disclosure of D1 in a specific

manner to arrive at least at an article which is similar to the article according to claim 1.

The appellant argued that all the examples in D1 disclosed a reflective layer made of CrN.

Even though the skilled person could focus on certain preferred options such as the use of CrN as the reflective layer due to its use in the examples in D1, D1 does not prompt the skilled person

- to always select the maximum value for all thickness options disclosed in D1,
- to select CrN for the intermediate layer, which is not the preferred material according to D1 (see examples and page 15, lines 1 to 5 of D1), and finally
- to modify the multi-layered structure by changing the composition of the previously selected CrN layer.

They are not motivated by the further additional documents cited by the appellant, either.

Documents such as D2 (claim 1), D4 (paragraphs [0008], [0020]-[0023] and [0032]; Figure 5) and D5 (Chapter 7) confirm that the skilled person knows that graded CrN layers can be obtained by PVD techniques and contribute to enhancing the durability of CrN coatings.

However, the knowledge concerning graded CrN layers does not give them an incentive to make all the selections within the generic disclosure of D1 or to replace one of the layers disclosed in this document with a graded layer.

Hence, starting from the generic disclosure of D1, the subject-matter of claim 1 is not obvious.

7.1.7 The appellant has not challenged the reasoning starting from Example 4 of D1 presented in the contested decision (see paragraph bridging pages 8 and 9 of the decision). Therefore, the Board sees no reason to deviate from the opposition division's finding in this regard.

7.2 Starting from D2

7.2.1 Starting from D2 as the closest prior art, the subject-matter of claim 1 differs

- in that the coated articles comprise a first chromium nitride material layer having a uniform chromium concentration having a thickness from 200 to 1000 nanometers; and
- in that the thickness of the (second) chromium nitride material layer having a graded chromium concentration is from 100 to 150 nanometers.

7.2.2 Even when accepting, for the sake of argument, that the underlying objective problem to be solved is to provide an alternative, the skilled person is not motivated to modify the process in D2 in order to arrive at an article according to claim 1 of the patent.

The required modification would go against the explicit teaching of D2, which is directed to a coating predominantly comprising a CrN layer having a continuously increasing chromium content (see claim 1 and column 1, lines 57 to 65). Starting from D2 it is therefore not obvious to increase the processing time and/or to modify the process conditions in order to additionally deposit a uniform CrN layer having a

thickness according to claim 1 of the patent. Indeed, the required modification to the article disclosed in D2 would result in a uniform CrN layer which is thicker than the second layer, i.e. thicker than the layer which forms the core of the invention of D2; see claim 1 and Table 1 of D2.

Moreover, the skilled person is not motivated to additionally apply the CrN layer having a continuously increasing chromium content in D2 in a relatively low thickness as defined in claim 1 (100 to 200 nm) while considering that this layer is supposed to provide wear resistance to the piston ring in D2; see column 5, lines 11 to 19.

7.2.3 In view of the above the Board concludes that the subject-matter of claim 1 is not obvious in view of D2.

7.3 Starting from D4

7.3.1 D4 discloses mirrors for use in automotive and projection televisions (PTV) comprising a glass substrate, a reflective layer of chromium nitride and a further chromium layer; see claim 42 of D4. The reflective layer of chromium nitride may be uniform or it may be graded and it can have a thickness of 200-700 Ångström (20-70 nm); see paragraphs [0023] and [0024], and Figures 4 and 5 of D4.

Two specific embodiments are described in D4, which have the following layered structure.

Embodiment 1 as shown by Figure 4:

- glass substrate
- CrN_x with uniform nitrogen content
(see paragraphs [0023] and [0031])
- metallic Cr

Embodiment 2 as shown in Figure 5:

- glass substrate
- CrN_x with graded nitrogen content
(see paragraphs [0023] and [0032])

7.3.2 The subject-matter of claim 1 differs from the mirrors in embodiment 1 of D4 in that a graded chromium nitride material layer having a thickness of 100 nm to 200 nm is located between the uniform CrN_x layer and the metallic chromium layer and in that the CrN_x layer having a uniform nitrogen content has a thickness of 200 to 1000 nm.

The subject-matter of claim 1 differs from the mirrors in embodiment 2 of D4 in that a uniform chromium nitride material layer having a thickness of 200 nm to 1000 nm is located between the glass substrate and the graded CrN_x layer and in that the CrN_x layer having a graded nitrogen content has a thickness of 100 nm to 200 nm.

7.3.3 Even when accepting, for the sake of argument, that the underlying objective problem to be solved is to provide an alternative, the skilled person is not motivated to combine the individual and separate embodiments of D4 and at the same time to change the thickness of the CrN_x layer, contrary to the disclosure in paragraph [0024] of D4.

- 7.3.4 The Board therefore concludes that the subject-matter of claim 1 is not obvious when starting from D4.
- 7.4 In line with the arguments presented by the parties, the same arguments regarding inventive step apply to claim 9 as apply to claim 1.
- 7.5 It follows from the above that the ground of opposition pursuant to Article 100(a) EPC in combination with Article 56 EPC does not prejudice the maintenance of the patent as granted.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



C. Spira

C. Herberhold

Decision electronically authenticated