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Datasheet for the decision of 14 June 2016

Case Number: T 0944/12 - 3.5.07

Application Number: 04026812.0

Publication Number: 1505584

IPC: G11B7/24, G11B7/26

Language of the proceedings: EN

Title of invention:
Metal alloys for the reflective or the semi-reflective layer of an optical storage medium

Patent Proprietor:
Target Technology Company, LLC.

Opponents:
Heraeus Deutschland GmbH & Co. KG
C-Corb B.V.

Headword:
Silver alloys for semi-reflective layer/TARGET TECHNOLOGY

Relevant legal provisions:
EPC Art. 56, 76(1)

Keyword:
Divisional application - added subject-matter (no) - after amendment
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 0944/12 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 14 June 2016

Appellant: (Patent Proprietor)	Target Technology Company, LLC. 564 Wald Irvine, CA 92618 (US)
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Respondent: (Opponent 2)	Heraeus Deutschland GmbH & Co. KG Heraeusstr. 12-14 63450 Hanau (DE)
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Respondent: (Opponent 3)	C-Corb B.V. Jan Frederik Vlekkeweg 8-02 5026 RJ TILBURG (NL)
Representative:	Peters, Sebastian Martinus Octrooibureau Vriesendorp & Gaade B.V. Koninginnegracht 19 2514 AB Den Haag (NL)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 16 February 2012 revoking European patent No. 1505584 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	R. Moufang
Members:	M. Rognoni
	P. San-Bento Furtado

Summary of Facts and Submissions

I. The appellant (patent proprietor) appealed against the decision of the Opposition Division to revoke the European patent no. 1 505 584, which had been granted on the divisional application no 04026812.0 of the parent application no. 01110879.2, published with the publication no. 1 174 868.

II. Notices of opposition had been filed by Williams Advanced Materials Inc. (former opponent 01), W.C. Heraeus GmbH (opponent 02) and C-Corb B.V. (opponent 03).

All opponents had based their oppositions on Article 100(a) EPC (lack of novelty and inventive step) and Article 100(c) EPC. The grounds for opposition of opponent 02 included also Article 100(b) EPC.

III. With letter dated 1 December 2011 the opponent 01 withdrew its opposition and thereby ceased to be a party to the proceedings.

IV. The following documents are cited in the Board's decision:

D1: US-A-6 007 889;
D4: JP-A-07-320324 (and English translation);
D28: JP-A-10-188354 (and English translation);
D29: JP-A-03-122845 (and English translation);
D32: CN-A-1 248 044;
D34: EP-A-0 251 794:
D36: Article published in "Economics Daily" 16 August 2000 (and English translation);

D37: Expert Report of S.P. Baker submitted by the patent proprietor with the statement of grounds of appeal;

D42: Kirk-Othmer: "Encyclopedia of Chemical Technology", Volume 20, John Wiley & Sons, Inc., page 347.

V. In the contested decision, the Opposition Division came, *inter alia*, to the following conclusions:

- as independent claims 1 and 2 of the granted patent (main request) contained subject-matter which extended beyond the content of the earlier application as filed, the granted patent did not comply with the requirements of Article 76(1) EPC;

- claims 1 and 5 according to auxiliary request I (filed at the oral proceedings on 1 February 2012) and according to auxiliary request II (submitted as "auxiliary request" with letter dated 30 November 2011) did not comply with Article 76(1) EPC;

- the subject-matter of claim 1 according to auxiliary request III, filed at the oral proceedings on 1 February 2012, lacked an inventive step pursuant to Article 56 EPC with respect to documents D1 and D4;

- the subject-matter of claim 1 according to auxiliary request IV (filed at the oral proceedings on 1 February 2012) lacked an inventive step with respect to D1 and the teaching of document D29.

VI. With the statement of grounds of appeal, the appellant submitted auxiliary requests 1 to 9 and requested that

the decision under appeal be set aside and the patent be maintained as granted (main request) or according to one of the enclosed auxiliary requests 1 to 9. Auxiliarily, the appellant requested oral proceedings. Furthermore, in support of its arguments, the appellant submitted some test results.

VII. The opponent 02 (respondent I) did not make any submissions relating to the appellant's statement of grounds.

VIII. The opponent 03 (respondent II) contested, with letter dated 7 February 2013, the appellant's arguments set out in the statement of grounds of appeal and requested that the appeal be dismissed. Auxiliarily, it also requested oral proceedings.

IX. In response to the submissions of the respondent II, the appellant, with letter dated 12 June 2013, filed an amended main request and auxiliary requests 1 to 9. The new requests were meant to replace all previous requests.

X. With a communication dated 28 January 2015, the EPO confirmed that the name of the opponent 02 (respondent I) had been amended to "Heraeus Deutschland GmbH & Co. KG".

XI. With letter dated 30 November 2015, the parties were summoned to oral proceedings to be held before the Board on 14 June 2016.

XII. The respondent I informed the Board with letter dated 24 February 2016 that it would not take part in the oral proceedings of 14 June 2016.

XIII. In a communication pursuant to Article 15(1) RPBA dated 8 April 2016, the Board made a preliminary assessment of the parties' arguments and pointed to the relevant issues that were to be discussed at the oral proceedings.

XIV. With letter dated 20 April 2016, the respondent II informed the Board that it would not attend the oral proceedings.

XV. In reply to the Board's communication, the appellant submitted, with letter dated 31 May 2016, an amended main request, which replaced the main request on file, and alternative auxiliary requests 1a to 10a.

XVI. Oral proceedings before the Board were held as scheduled on 14 June 2016. In the course of these proceedings, the appellant submitted a new main request which replaced all previous requests on file. At the end of the oral proceedings, the Chairman pronounced the Board's decision.

XVII. The appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of the main request filed at the oral proceedings.

The respondent II requested in writing that the appeal be dismissed.

No request was made by the respondent I.

XVIII. Claim 1 of the appellant's new main request (= sole request) reads as follows:

"An optical storage medium, comprising:

a first layer (214; 314; 318) having a pattern of pits and lands (215; 315; 319) in at least one major surface; and a first coating (216; 316, 320) adjacent the first layer, the first coating being semi-reflective and having a thickness of 5 to 20 nm and consisting of a first metal alloy; a second layer (218; 322) having a pattern of pits and lands (219; 323) in at least one major surface; and a second coating (220; 324) adjacent the second layer, the second coating being a highly reflective coating and consisting of a second metal alloy;

(i) wherein the first metal alloy is a silver-rich alloy that includes, in addition to Ag, at least one alloying element selected from the group consisting of In, Sn, Ni, Zr, Cr, Sb, Ga, Si, B, Mo and mixtures thereof, the alloying element being present from about 0.01 a/o percent to about 5.0 a/o percent of the amount of Ag present; or

(ii) wherein the first metal alloy is a silver-rich alloy that includes, in addition to Ag, Cu and Ti as further alloying elements, wherein the relationship between the amounts of Ag and Cu ranges from about 0.01 a/o percent to about 5.0 a/o percent Cu and from about 95.0 a/o percent to about 99.99 a/o percent Ag, and the further alloying element Ti is present from about 0.01 a/o percent to about 5.0 a/o percent of the amount of Ag present."

Claims 2 and 3 are dependent on claim 1.

Claim 4 reads as follows:

"A DVD dual-layer optical storage medium, comprising: a first layer (214; 314; 318) having a pattern of pits and lands (215; 315,; 319) in at least one major surface; and a first coating (216; 316, 320) adjacent the first layer, the first coating being semi-reflective and having a thickness of 5 to 20 nm and consisting of a first metal alloy; a second layer (218; 322) having a patten of pits and lands (219; 323) in at least one major surface; and a second coating (220; 324) adjacent the second layer, the second coating being a highly reflective coating and consisting of a second metal alloy;

(i) wherein the first metal alloy is a silver-rich alloy that is Ag+Ti, the alloy addition to silver being not more than 5.0 a/0 percent."

Claims 5 to 8 are dependent on claims 1 and 4.

XIX. Some of the appellant's arguments relevant to the Board's decision may be summarised as follows:

The new main request overcame all objections under Article 76(1) raised in the contested decision.

Document D1, which was regarded as the closest prior art, disclosed Cu-based and Ag-based alloys for thin films which could be used as highly reflective or semi-reflective layers in optical recording media. Ag was alloyed with small amounts of Au (AgAu) or Pd (AgPd) or both (AgAuPd). These binary or ternary alloy systems could be further refined by adding Cu or Rh. According to a further embodiment, Ag-based binary and ternary

alloy systems could be further alloyed with Ru, Os, Ir, Pt, Be or mixtures thereof.

Starting from document D1, the problem addressed by the contested patent consisted in providing alloys based on Ag, but which did not contain any noble metal as alloying element and possessed adequate corrosion resistance for application as semi-reflective layer in a dual-layer optical storage medium or dual-layer DVD.

Document D4, which related to a magneto-optical recording medium with one magnetic layer as the only data recording layer, disclosed a half-reflecting layer based on Au, Ag, Cu or alloys thereof and taught that, for increasing corrosion resistance of Ag and Cu, Au, Pt, Pd, Rh, Mo, Ta, or Ti could be added. Starting from this teaching of document D4, a first selection had to be made from Au, Ag and Cu or two elements or more thereof, and a second selection from the above list of elements used to increase corrosion resistance, so as to arrive at alloys based on Ag and Mo or Ti according to the present invention. Furthermore, in order to apply a selection of alloys disclosed for magneto-optical storage media to a dual-layer, DVD-type medium, the skilled person would have to expect that alloys, which had been developed to meet the corrosion resistance requirements of semi-reflective layer in a magneto-optical storage medium, would show sufficient corrosion resistance also in a recording medium where the semi-reflective layer had a totally different function as well as totally different neighbouring layers.

In fact, a semi-reflective layer in a dual-layer data-recording structure like a DVD-9 required a particular high corrosion resistance due to the effect of the

neighbouring UV-curable resin, whereas the reflective layer in a magneto-optical storage medium could be protected by inorganic protective layers, as pointed out in the expert report D37. Moreover, a semi-reflective layer in a magneto-optical storage medium was meant to improve the read-out of the magneto-optical layer by increasing the Kerr rotation angle and thus served a different purpose. As a skilled person had no incentive to apply the teaching of document D4 to a DVD-9-type structure with a reasonable expectation of success, it would not have been obvious to combine the teachings of D1 and D4.

Document D29 showed in table 1, example 3, an Ag-Sn alloy used for reflective layers in optical recording media. However, D29 related to single-layer magneto-optical discs with improved reflectivity, and not to a semi-reflective layer in a dual-layer optical storage medium. In fact, a prior art teaching relating to highly reflective layers could not be simply transferred to semi-reflective layers by decreasing the layer thickness. A newly formed layer, subject to corrosion, had to result in some combination of reflectivity, transmissivity, and absorptivity. All three results could be better achieved with a thick layer than with a thin layer, as corrosion had a greater impact on the characteristics of the latter.

Hence, as stated in the Expert Report D37, a person skilled in the art would not have found the teachings of document D29 applicable to dual-layer, pits-and-lands-type optical storage media of the kind considered in the contested patent. In fact, document D29 showed in table 1 only one example of a high-reflective layer of 40 nm thickness (see page 11, last paragraph) formed of an Ag-alloy (*i.e.* AgSn) as specified in claim 1.

In summary, the person skilled in the art would not consider document D29 as a promising teaching for solving the practical problems related to the corrosion resistance of semi-reflective metal alloy layers in DVD-9-type structures.

Document D36 related to smelting technology of hard reflective alloy targets for DVD-9. Au, Ag and Ag-Ti targets were only mentioned as reflective layer materials. In a subsequent passage, it was referred to products of Ag alloy targets for half-reflective layers. However, no connection was made with the targets mentioned above. Thus, D36 did not teach using Ag-Ti targets for forming the semi-reflective layer of DVD-9.

The reference D42 only disclosed the high strength-to-weight ratio and good corrosion resistance of Ti making it especially attractive for aerospace and chemical applications. No incentive for the person skilled in the art could be derived to employ Ti in Ag-rich alloys for the production of optical storage media.

XX. The respondent II argued in writing essentially as follows:

In the grounds of appeal, the appellant considered that the technical problem with respect to document D1 was to provide further Ag-based alloys for a semi-reflective layer which did not employ precious metals, but had high corrosion resistance.

None of the examples of alloys given in the opposed patent was shown to have the required corrosion

resistance. The appellant had tried to remove this lack of experimental support by introducing new experimental results with the statement of grounds of appeal. However, these experimental results should not be taken into consideration as late-filed since they could have been submitted at a much earlier stage in the proceedings.

Apart from that, the limited number of alloys used to obtain the experimental results could not prove that the claimed subject-matter, which covered an infinite number of combinations of elements and proportions of elements, would solve the addressed problem.

In order to meet the DVD standard, a semi-reflective layer should have a reflectivity of between 18 and 30%. If the percentage of the alloying element became too high, reflectivity would become lower. The threshold for this was different for each alloying element.

Furthermore, every alloy would behave differently in a metallizer when the material was deposited on a disc. In other words, to achieve the necessary property profile, many different parameters, apart from the choice of alloy, had to be selected. However, none of the claimed alloys was supported by experimental results and thus it would take undue burden to find out whether (and in which composition) one of the claimed alloys would achieve the desired result.

Document D4 remained highly relevant even if it related to magneto-optical disks, as the technical problem to be solved concerned the properties of a semi-reflective layer, and not the properties of a recording medium. The combination of the teaching of documents D1 and D4 would have led the skilled person, addressing the

problem of improving the corrosion resistance of a semi-reflective layer in a recording medium, to the invention according to the contested patent.

Document D36 disclosed Ag-Ti as silver alloy. The claimed subject-matter would not be inventive as a result of the combination of documents D1 and D36.

It was furthermore general knowledge that Ti was an element with good corrosion resistance (see D42). The person skilled in the art, when confronted with the problem of replacing an expensive Pd or Au alloying element of a semi-reflective layer by something less expensive, would consider adding Ti as a replacement for Pd or Au since Ti was an element with good corrosion resistance (see D42). Hence, in the light of this general knowledge and of D36, the person skilled in the art, when confronted with the problem of replacing an expensive Pd or Au alloying element of a semi-reflective layer by something less expensive, would consider adding Ti as a replacement for Pd or Au and thus arrive at the subject-matter of claim 1.

XXI. Further relevant points made by the parties are summarised and addressed in the reasons.

Reasons for the Decision

1. The appeal is admissible.

The invention

2. The opposed patent relates to an optical storage medium comprising a highly reflective layer coating a data storage layer provided with a pattern of pits and

lands, and a semi-reflective, semi-transparent layer coating another data storage layer having another pattern of pits and lands. Data is read out by focusing a laser beam either onto the semi-reflective layer or through the semi-reflective layer and onto the highly reflective layer. These storage media have been known in the art, for instance, as DVD-9 and Blu-ray discs.

2.1 According to paragraph [0020] (page 4, lines 4 to 10), the potential choice of the reflective layer would be pure gold, pure silver and aluminium alloys. However, gold is comparatively more expensive than other metals. Pure silver has higher reflectivity and thermal conductivity than gold, but its corrosion resistance is relatively poor as compared to gold. Aluminium alloys' reflectivity and thermal conductivity are considerably lower than those of either gold or silver.

2.2 The present invention aims at providing metallic alloys for thin film reflective layers which have high reflectivity, sputtering characteristics similar to gold and high corrosion resistance, and which are also inexpensive. When a reflective layer is made thin enough, it becomes semi-reflective and transmissive to laser light and is thus suitable for dual-layer optical media with data layers read out from one side (cf. paragraph [0024] and Figure 3 of the published patent).

3. The granted patent had four independent claims (claims 1 to 4), directed to an optical storage medium comprising the following features:

- a first layer having a pattern of features in at least one major surface; and
- a first coating adjacent the first layer,

- the first coating being semi-reflective and including a first metal alloy;
- wherein the first metal alloy is a silver-rich alloy.

3.1 In claim 1, the silver-rich metal alloy was defined as an alloy:

- that includes, in addition to silver (Ag), at least one alloying element selected from the group consisting of indium (In), tin (Sn), titanium (Ti), nickel (Ni), zirconium (Zr), chromium (Cr), antimony (Sb), gallium (Ga), silicon (Si), boron (B), molybdenum (Mo) and mixtures thereof.

3.2 In claim 2, the silver-rich alloy was defined as an alloy:

- that consists, in addition to Ag, of copper (Cu) or cadmium (Cd).

3.3 In claim 3, the silver-rich alloy was defined as an alloy:

- that includes, in addition to silver (Ag), Cu and at least one further alloying element selected from the group consisting of Al, Ni, Mn, Ti, Zr, In, Cr, Ge, Sn, Sb, Ga, Si, B, Mo and mixtures thereof.

3.4 In claim 4, the silver-rich alloy was defined as follows:

- that includes, in addition to Ag, lithium (Li).

Decision of the Opposition Division

4. In the contested decision, the Opposition Division noted that the parent application only disclosed particular combinations of AgCu, AgCd, AgLi and AgTi with defined atomic percentages. These individual disclosures of specific alloys did not support broader definitions of corresponding alloys given in claims 1 and 2 of the granted patent. In particular, the Opposition Division noted that Ag+Ti was indeed mentioned in a list of silver alloys (page 32, lines 10 to 28 of the parent application). However, it was not clear what the object of that list was and there was no specific reference to the use of the listed alloys in an optical storage medium, or to their use for a semi-reflective layer. In fact, the passage of page 32 listing some combinations of Ag-alloys appeared unrelated to the rest of the description. Similarly, AgCd alloys was only mentioned in the list on page 32 of the parent application or as a specific example in table 1.

Hence, the Opposition Division concluded that claims 1 and 2 did not comply with Article 76(1) EPC.

4.1 The Opposition Division drew similar conclusions with respect to the auxiliary requests I and II then on file.

4.2 No objection under Article 76(1) EPC was raised against auxiliary requests III and IV then on file.

4.3 As to auxiliary request III, the Opposition Division observed that the subject-matter of claim 1 differed from the closest prior art document D1 in that the Ag-based alloy comprised an element selected from In, Ni, Zr, Cr, Sb, Ga, Si, B, Mo and mixtures thereof. The technical problem to be solved was providing an

alternative silver-rich alloy for thin reflective layers. According to the Opposition Division, D4 disclosed a series of silver-rich alloys for semi-reflective layers in a magneto-optical recording medium. The alloying elements included Ni, Zr, Cr, Ti and Mo.

In the Opposition Division's opinion, the skilled person, starting from document D1 and wishing to address the above problem, would have taken document D4 into consideration. In doing so, the skilled person would have arrived at subject-matter of claim 1 without the use of inventive skills (Article 56 EPC).

4.4 The Opposition Division used a similar approach to arrive at the conclusion that the subject-matter of claim 1 according to auxiliary request IV lacked an inventive step. In this case, however, its reasoning was based on the combination of documents D1 and D29. The Opposition Division acknowledged that document D29 did not refer to semi-reflective layers. However, in its opinion, the skilled person would nevertheless take the teaching of D29 into account because it related to thin reflective layers. As stated in the contested patent, semi-reflective layers are layers having a thickness of 5 to 20 nm.

The appellant's request and Article 123(3) EPC

5. The appellant submitted its sole request during the oral proceedings before the Board. Although the request was filed late in the appeal proceedings, it does not constitute a surprising development but an appropriate reaction to the discussion of relevant issues and possible objections against requests previously on file. Since the Board is able to deal with this request

without adjournment of the oral proceedings (see Article 13(3) RPBA) and the non-attending respondents are to be treated as relying only on their written case (Article 15(3) RPBA), the Board admits the request into the proceedings in the exercise of its discretion under Article 13(1) RPBA.

5.1 The appellant's request now comprises two independent claims (claim 1 and claim 4) directed to an optical storage medium having the following features:

(a) a first layer having a pattern of pits and lands in at least one major surface; and
(b) a first coating adjacent the first layer, the first coating
    (i) being semi-reflective and
    (ii) having a thickness of 5 to 20 nm and
    (iii) consisting of a first metal alloy;
(c) a second layer having a pattern of pits and lands in at least one major surface; and
(d) a second coating adjacent the second layer,
    (i) the second coating being a highly reflective coating and
    (ii) consisting of a second metal alloy.

5.2 Claim 1 covers two alternatives, identified as (i) and (ii) in the claim, which relate to the composition of the first metal alloy.

The first alternative (i) specifies the first metal alloy as:

(xi) a silver-rich alloy that includes, in addition to Ag, at least one alloying element selected from the group consisting of In, Sn, Ni, Zr, Cr, Sb, Ga, Si, B, Mo and mixtures thereof.

Furthermore, the amount of alloying element is defined as follows:

(e) the alloying element being present from about 0.01 a/o percent to about 5.0 a/o percent of the amount of Ag present.

The second alternative, identified as (ii) in the claim, defines the first metal alloy as follows:

(xii) the first metal alloy is a silver-rich alloy that includes, in addition to Ag, Cu and Ti as further alloying elements,

(xiii) wherein the relationship between the amounts of Ag and Cu ranges from about 0.01 a/o percent to about 5.0 a/o percent Cu and from about 95.0 a/o percent to about 99.99 a/o percent Ag.

In addition, the further alloying element Ti is present from about 0.01 a/o percent to about 5.0 a/o percent of the amount of Ag present, as specified in feature (e) above.

5.3 The other independent claim 4 of the appellant's request is directed to a DVD dual-layer optical storage medium comprising features (a) to (d) specified above. In addition, the first metal alloy is defined as:

(xiv) a silver-rich alloy that is Ag+Ti, the alloy addition to silver being not more than 5.0 a/o percent.

5.4 It follows from the above that, compared with claim 1 as granted, both alternatives (i) and (ii) of claim 1 of the appellant's request have a narrower scope of protection insofar as they are limited to dual layer optical media (= features (a) and (c) above) comprising a semi-reflective first coating on the first layer with

a thickness between 5 and 20 nm (= feature (b)(ii) above).

Alternative (i) is further limited to a silver-rich alloy according to feature (xi). Alternative (ii) is limited to a silver-rich alloy that includes Ag, Cu and Ti. Both alternatives are encompassed by claim 1 as granted.

Claim 4 is a further limitation with respect to claim 1 of the patent to a DVD dual-layer optical storage medium and to a silver-rich alloy that contains Ti.

5.5 Hence, the appellant's request complies with Article 123(3) EPC.

Article 76(1) EPC

6. The first alternative covered by claim 1 of the appellant's request no longer mentions Ti as alloying element (see features (xi) and (e) of the Board's itemisation) and corresponds to the first alternative specified in claim 1 of auxiliary request III considered in the contested decision.

Feature (xi) and feature (e) find support in the paragraph bridging pages 32 and 33 of the original description of the parent application.

6.1 The second alternative of the appellant's request (see features (xii), (xiii) and (e) of the Board's itemisation) is disclosed in the parent application at page 36, lines 1 to 22.

7. Claim 4 is directed to a DVD dual-layer optical storage medium with a semi-reflective layer consisting of a

generic AgTi alloy which the Opposition Division did not consider disclosed in the parent application (see point 4 above).

7.1 The respondent II essentially argued in its response to the statement of grounds of appeal (see letter dated 7 February 2013, page 7) that several of the Ag-alloys listed at page 32, lines 10 to 27, of the original parent application displayed properties which made them unsuitable for use in the context of the invention. In particular, the respondent II referred to AgCr and AgLi.

7.2 In support of the subject-matter of claim 4, the appellant has referred to page 32, line 15, to table 1, penultimate example, on page 31, and to page 16, last paragraph, of the parent application, which described the structure of the dual-layer optical storage medium shown in Figure 3 and referred to "the alloys presented below", that is in the following pages of the description, as being used to form a reflective or a semi-reflective layer deposited on the pit and land patterns. A further indication of the link between the AgTi alloys and a DVD-9 dual layer disc was given in the caption of table 1 on page 31.

Furthermore, the limitation that the alloy addition to silver was not more than 5.0 a/o percent could be derived from the statement at page 36, lines 22 to 29, which clearly applied to any silver-rich alloy and explained that the required balanced reflectivity between the two layers of a DVD-9 dual layer could not be achieved if the alloying element added to silver was more than 5.0 a/o percent.

7.3 On balance, the Board finds the appellant's arguments convincing. The whole parent application is concerned with the problem of providing Ag-rich alloys suitable for the reflective layer or the semi-reflective layer of an optical storage medium. The list of alloys on page 32 is preceded and followed by further examples of alloys which are explicitly defined as embodiments of the invention. Furthermore, Table 1 includes a specific example of an AgTi alloy. Thus, even if some Ag-alloys listed on page 32, lines 10 to 27, may turn out to be ill-suited as materials for a semi-reflective layer, the Board accepts that the list was meant to identify potentially suitable alloys and that at least AgTi was certainly considered by the applicant as a viable choice, as the example given in table 1 of page 31 of the parent application shows.

As to the limitation of the amount of alloying element added to silver to not more than 5.0 a/o percent, the Board agrees with the appellant that it does not refer only to the preceding examples of alloys, but is to be interpreted as a general requirement, as the reference to the data presented in tables I, II, and III indicates. In the Board's opinion, it is legitimate to apply the limitation of the alloying element to no more than 5.0 a/o percent also to the AgTi alloy specified in claim 4. Incidentally, this is consistent with the range specified in feature (e) for the two alternatives recited in claim 1.

7.4 In summary, the Board concludes that the appellant's request complies with Article 76(1) EPC.

Article 54 EPC

8. It has not been contested that the subject-matter of claims 1 and 4 of the appellant's request is new with respect to the available prior art.

8.1 The Board is also satisfied that none of the cited documents discloses all the features recited in claims 1 or 4. The subject-matter of these claims is thus new within the meaning of Article 54 EPC.

Article 56 EPC

9. Document D1, which uncontestedly represents the closest prior art, relates to reflective layers used in optical storage media and, in particular, in DVD-dual layer optical media (see Figure 3).

As pointed out in column 3, lines 6 to 15, a dual-layer disc has two information layers, which are both played back from one side. In this arrangement, a layer is semi-reflective, in the sense that, in addition to reflecting light, it must also pass a substantial amount of light so that the laser beam can reach the highly reflective layer underneath and then reflect back through the semi-reflective layer to the signal detector.

9.1 According to D1 (column 3, lines 17 to 35), the potential choice of the semi-reflective layer is either gold or silicon. Gold, when sufficiently thin, will both reflect and transmit light and has outstanding corrosion resistance. However, it is comparatively more expensive than other metals. Silicon has, *inter alia*, the drawback that it requires a more complicated sputtering apparatus than other reflective metals.

Document D1 seeks therefore to provide alloys that have the advantages of gold when used as material for a reflective layer or a semi-reflective layer in an optical storage medium, but are not as expensive as gold.

9.2 The alloys disclosed in document D1 are Cu-based and Ag-based. According to the teaching of D1, Ag is alloyed with small amounts of Au (AgAu) or Pd (AgPd) or both (AgAuPd) (D1, column 6, lines 16 to 49). These binary or ternary alloy systems can be further refined by adding Cu or Rh (D1, page 6, lines 60 to 64).

According to a further embodiment (D1, column 7, lines 12 to 15), Ag-based binary and ternary alloy systems can be further alloyed with Ru, Os, Ir, Pt, Be or mixtures thereof. If one or a mixture of these precious metals replaces a portion of Ag in the alloy, then the corrosion resistance of the resultant thin film will increase, but the reflectivity will drop (D1, column 7, lines 15 to 18). Cu-based alloys are combinations of Cu with Cd, Au, Mg or Ni (see claims 27 to 30 of D1).

9.3 The contested patent addresses essentially the same problem as document D1, in the sense that it also aims at providing alternative metallic alloys for thin film reflective and semi-reflective layers that have high reflectivity and similar sputtering characteristics as gold, and are corrosion resistent and yet inexpensive. However, the present invention is in particular concerned with providing alloys which do not rely on precious metals as alloying elements, and are therefore even less expensive.

9.4 Hence, the gist of the present invention consists essentially in providing Ag-based alloys obtained by

alloying Ag with suitable amounts of one or more non-precious metals as specified in claims 1 and 4.

10. In its response to the statement of grounds of appeal, the respondent II argued, *inter alia*, that none of the examples of the opposed patent showed an effect with respect to corrosion resistance. The appellant had tried to remove this lack of experimental support by introducing new experimental results with the statement of grounds of appeal. However, a limited number of alloys used to obtain experimental results could not prove that the claimed subject-matter, which covered an infinite number of combinations of elements and proportions of elements, would solve the addressed problem.

In order to meet the DVD standard, a semi-reflective layer should have a reflectivity of between 18 and 30%. If the percentage of the alloying element became too high, reflectivity would become lower. The threshold for this was different for each alloying element.

Furthermore, in the opinion of the respondent II, every alloy would behave differently in a metallizer when the material was deposited on a disc. In other words, to achieve the necessary property profile, not only the choice of alloy determined whether such an alloy was suitable. As none of the claimed alloys was supported by experimental results, it would take undue burden to find out whether (and in which composition) one of the claimed alloys would achieve the desired result.

10.1 In the Board's opinion, the appellant has plausibly demonstrated that alloys as defined in claims 1 and 4 can in principle replace Ag-alloys based on precious

metals as alloying elements and thus provide viable alternatives to the alloys disclosed in document D1.

10.2 As to the very broad range for the amount of alloying element specified in the independent claims, the appellant has acknowledged that high corrosion resistance could not be expected from an alloy with an amount of alloying element close to the low boundary of the claimed range. However, the appellant has convincingly argued that the underlying idea of the invention was to use non-precious metals as alloying elements in an Ag-rich alloy for a semi-reflective layer. The effect, improved corrosion resistance over an Ag layer, was achieved even with the addition of small amounts of alloying elements as specified in claims 1 and 4. Since there was no universally agreed standard of corrosion resistance in the field of optical storage media, even a small improvement in corrosion resistance could be useful for certain applications.

10.3 The Board agrees with the appellant that the solution to the problem addressed by the contested patent consists in providing alloys suitable as material for the semi-reflective layer of a dual-layer optical medium which are essentially Ag-based and comprise some specific non-precious metals as alloying elements. The skilled person, following the teaching of the contested patent and knowing that increasing the amount of alloying element would in principle enhance corrosion resistance but reduce reflectivity, would be able to find the appropriate amount of alloying element to add to Ag in order to achieve the desired corrosion resistance and reflectivity.

11. It has not been contested by the appellant that it was known before the priory date of the contested patent to use some of the alloys covered by claim 1 as reflective or layers for some kind of optical media.

11.1 In particular, document D4 relates to a magneto-optical recording medium comprising, *inter alia,* a magnetic layer sandwiched between a semi-reflective layer and a reflective layer. As explained in paragraphs [0015] and [0016] of the English translation, the semi-reflective layer preserves a certain reflection factor sufficient to reflect light, but at the same time transmits part of the light. The transmitted light undergoes multiple reflections at the magnetic, reflective and optical interference levels so that its Kerr angle of rotation increases. The semi-reflective layer then transmits light with increased Kerr angle in opposite direction to the light receiving element.

As observed in D4 (paragraph [0017]) a desirable thickness for the semi-reflective layer is 5 to 40 nm, and 10 to 30 nm is best. Furthermore, *"the principal ingredient for the thin film constituting the semi-reflective layer may be any one of Au, Ag or Cu, or in particular, a combination of two or more of these".*

For a magneto-optical medium meant to be operated with a light source of wavelength less than 600 nm, *"it is best to use Ag as the principal component for the thin film for the semi-reflective layer"* (paragraph [0018]).

To increase corrosion resistance in a semi-reflective layer consisting of a film of Ag, Cu or their alloys, it is advisable to add one or more elements of the following elements: Au, Pt, Pd, Rh, Mo, Ta and Ti. The

ideal concentration is between 0.5% atomic and 10% atomic (paragraph [0020]).

Document D4 further advises to reduce thermal conductivity in order to improve recording sensitivity by an addition of the following elements: Ti, V, Cr, Mn, Fe, Co, Ni, Zr, Nb, Mo, Ta, W, Hf and Bi (paragraph [0021]).

11.2 In summary, document D4 teaches, *inter alia*, using a silver-rich alloy such as AgTi, AgMo, AgCuTi for a semi-reflective layer, whereby the concentration range of Mo and Ti overlaps the range specified in feature (e) of claim 1.

12. As to the disclosure in document D4, the appellant has pointed out that this prior art stressed the importance of using one or two or more elements selected from a group comprised of Au, Ag and Cu for a semi-reflective layer provided in the structure of a magneto-optical medium in order to increase the Kerr rotation angle. In the working examples 1 and 3 given in D4, an Au film served as a semi-reflective layer, in working example 2, an Ag-film served as semi-reflective layer. As it was evident from table 1 in D4, the Ag semi-reflective layer led to a much lower Kerr rotation angle than the Au semi-reflective layer. Thus, in the appellant's view document D4 in fact indicated to the skilled person that only Au was successful for semi-reflective layers.

12.1 The appellant has furthermore stressed the essential differences between a magneto-optical medium and a dual-layer optical storage medium comprising features (a) to (d) of claims 1 and 4. In the former, the semi-reflective layer was in contact with smooth surfaces which could be more easily coated. Furthermore, a

protective coating could be used to further protect the semi-reflective layer from a corrosive environment. In dual-layer optical storage media, however, information was stored in patterns of pits and lands formed in a substrate and the semi-reflective layer had to reproduce exactly the surface profile of this substrate. Furthermore, no protective coating could be used to increase the corrosion resistance of the semi-reflective layer. On the other hand, in a dual-layer optical recording medium, the reflective and semi-reflective layer were in contact with a UV-curable resin which was used to bond together the two halves of the medium and which provided the environment in which corrosion took place.

12.2 Thus, in the appellant's view, the skilled person would not have combined the teaching of document D4 with the teaching of D1, in order to arrive at the claimed invention, without a reasonable expectation of successfully solving the problem of providing a corrosion resistent semi-reflective layer for a dual-layer optical storage medium.

13. The Board agrees with the appellant that document D4 does not teach using for a semi-reflective layer only an Ag-rich alloy combining Ag with non-precious alloying elements, as the contested patent, but, in principle, covers many possible alloys based on different combinations of noble elements with other noble elements or non-noble elements.

13.1 The appellant has also convincingly argued that magneto-optical discs and the dual-layer storage media specified in claims 1 and 4 constituted very different environments for a reflective or a semi-reflective layer. In fact, a reflective layer was more exposed to

corrosion in dual-layer optical storage media than in magneto-optical media.

13.2 Hence, the Board concurs with the appellant that the combination of the teaching of document D1 with the teaching of D4 would not have given the skilled person a reasonable expectation of success in the search for a solution to the problem of finding cheaper replacements for the alloys disclosed in D1. Consequently, the skilled person, focused on the search for cheaper alternatives to the alloys disclosed in document D1, would have disregarded the teaching of document D4.

13.3 Furthermore, the Board is of the opinion that even under the assumption that a person skilled in the art might have attributed some relevance to document D4 and considered its disclosure, it would not have been obvious to this skilled person, starting from document D1, to select among all the alloys disclosed in document D4 the specific alloys covered by claim 1 as possible successful candidates for solving the problem of finding suitable, but less expensive replacements for the alloys disclosed in D1.

14. In the contested decision, the Opposition Division had considered the combination of documents D1 and D29 prejudicial to the inventive step of the subject-matter of claim 1 according to the auxiliary request IV then on file.

14.1 Document D29 relates to a photomagnetic recording medium including a reflective layer based on an Ag alloy which may comprise, *inter alia*, 0.1 to 30 atomic % of Sn (page 5, last paragraph). The reflective layer is 10 to 100 nm, preferably 20 to 70 nm (page 6,

first full paragraph). The example of table 1 shows an AgSn alloy with a content of 5 atomic % of Sn.

As pointed out in the Expert Report D37 (cf. page 16, last paragraph and page 17, second full paragraph), document D29 shows in table 1 only one example of a high-reflective layer of 40 nm thickness formed of an Ag-alloy (*i.e.* AgSn), as specified in claim 1 of the appellant's request.

14.2 The Board accepts the appellant's argument that a thin semi-reflective layer is much more sensitive to corrosion than a thicker high reflective layer and that a dual-layer optical storage medium constitutes a much harsher environment for a reflective layer than single layer magneto-optical or photomagnetic media.

Hence, the Board agrees with the appellant that a skilled person would not have regarded the teaching of document D29 as applicable to the kind of dual-layer storage media considered in the contested patent.

14.3 The same applies to documents D28, D32 and D34 which disclose some alloys covered by the main request, but relate to the problem of providing alloys for the high reflective layer of a single layer optical medium.

15. Document D36 was published on 16 August 2000, that is between the two priority dates, 21 July 2000 and 13 April 2001, of the contested patent. If the older priority were not valid, as concluded by the Opposition Division but contested by the appellant, document D36 would be prior art according to Article 54(2) EPC and thus relevant for inventive step.

15.1 The Board has come to the conclusion that there is no need to decide whether the older priority date is actually valid, because in any case the disclosure in D36 does not prejudice the inventive step of the claimed subject-matter.

15.2 Document D36 is a short article taken from an economic newspaper. It states that Solar Applied Technology Co. has obtained *"the smelting technology of half-reflective alloy target for DVD-9. Solar Applied Materials (former Solar Chemicals) is one of the largest domestic CD-R target manufacturers and supplies the reflective layer materials such as Au target, Ag target and Ag-Ti target.*

Further down, it is specified that *"Solar Applied Materials obtains authorization of the inventor of silver alloy target for half-reflective layer as well...".*

In summary, the only explicit relevant information that can be extracted from document D36 is that, at the time of its publication, there was a company involved in the manufacture and supply of reflective layer materials, *inter alia* Ag-Ti target, for CD-R and that this company had also obtained the smelting technology of half-reflective alloy target for DVD-9 and, in particular, authorisation of the inventor of silver alloy target for half-reflective layer.

15.3 In the opinion of the Board, it is however not possible to establish on the basis of document D36 whether Ag-Ti targets were actually used, or intended to be used, to produce half-reflective layers for dual-layer optical media as specified in claim 4 of the appellant's request.

15.4 Document D42 reflects generally known characteristics of Ti, in particular high strength-to-weight ratio and good corrosion resistance. This document gives no information as to its possible application as alloying element in a Ag-Ti alloy for a semi-reflective layer in dual layer optical media.

16. All the remaining documents cited in the course of the opposition and appeal proceedings are further removed from the claimed subject-matter and thus bear no relevance to the question of its inventive step.

17. In summary, the Board finds that the subject-matter of claims 1 and 4 involves an inventive step with respect to any one of the cited combinations of prior art documents (Article 56 EPC).

18. From the above, the Board comes to the conclusion that the grounds of opposition do not prejudice the maintenance of the patent in amended form on the basis of the appellant's request.

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 with the order to maintain the patent in amended form on the basis of claims 1 to 8 of the new main request submitted in the oral proceedings before the Board, and the description and drawings yet to be adapted.

The Registrar: The Chairman:

I. Aperribay R. Moufang

Decision electronically authenticated