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**Datasheet for the decision
of 15 December 2011**

Case Number: T 2135/08 - 3.2.07
Application Number: 96906935.0
Publication Number: 852266
IPC: C23C 14/34, C23C 14/38
Language of the proceedings: EN

Title of invention:

Target, process for production thereof, and method of forming highly refractive film

Patent Proprietors:

Asahi Glass Company, Limited
AGC Glass Europe

Opponents:

Cohausz Hannig Dawidowicz & Sozien
Guardian Industries Corp.

Headword:

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Relevant legal provisions:

EPC Art. 54, 56, 100(c), 123(2)
RPBA Art. 12(2), 13(1), 13(3)

Relevant legal provisions (EPC 1973):

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Keyword:

"Admissibility of oral presentation of technical experts (no)"

"Admissibility of new documents (yes)"

"Admissibility of late filed auxiliary requests (1. to 4. auxiliary requests - yes; 5. to 11. auxiliary requests - no)"

"Extension beyond content of application as originally filed (no)"

"Novelty (main request - no, 1. auxiliary request - yes)"

"Inventive step (all admitted auxiliary requests - no) - partial problems"

Decisions cited:

G 0004/95, T 0331/87

Catchword:

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Case Number: T 2135/08 - 3.2.07

D E C I S I O N
of the Technical Board of Appeal 3.2.07
of 15 December 2011

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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
12 September 2008 concerning maintenance of
European patent No. 852266 in amended form.

Composition of the Board:

Chairman: H. Meinders
Members: H. Hahn
E. Dufrasne

Summary of Facts and Submissions

I. The appellants I and II (the opponents I and II) lodged an appeal against the decision of the Opposition Division for maintaining the European patent EP-B-0 852 266 in amended form on the basis of the claims 1-8 of the first auxiliary request dated 20 May 2008.

II. Independent claims 1, 3, 4 and 8 of the patent to be as maintained and corresponding to the main request of the respondents (patent proprietors) read as follows:

"1. A sputtering target comprising a substrate and a target material formed on the substrate, wherein the target material comprises a metal oxide of the chemical formula MO_x as the main component, wherein MO_x is a metal oxide which is deficient in oxygen as compared with the stoichiometric composition, and M is at least one metal selected from the group consisting of Ti, Nb, Ta, Mo, W, Zr and Hf, wherein in said MO_x , when M is Nb and/or Ta, x is within a range of $2 < x < 2.5$, when M is Mo and/or W, x is within a range from $2 < x < 3$, and when M is at least one metal selected from the group consisting of Ti, Zr and Hf, x is within a range of $1 < x < 2$, wherein the sputtering target is produced by a spraying method."

"3. A process for producing a sputtering target, which comprises forming an undercoat made of a metal or alloy on a substrate, and forming a ceramic layer as a target material on the undercoat, wherein the ceramic layer as a target material is formed by plasma spraying wherein

a ceramic powder which is made in a semi-molten state in a high temperature plasma gas in a reducing atmosphere, is transported and deposited onto the undercoat by the plasma gas, and, as the target material, a target material comprising a metal oxide of the chemical formula MO_x as the main component, is used, wherein MO_x is a metal oxide which is deficient in oxygen as compared with the stoichiometric composition, and M is at least one metal selected from the group consisting of Ti, Nb, Ta, Mo, W, Zr and Hf, wherein in said MO_x , when M is Nb and/or Ta, x is within a range of $2 < x < 2.5$, when M is Mo and/or W, x is within a range from $2 < x < 3$, and when M is at least one metal selected from the group consisting of Ti, Zr and Hf, x is within a range of $1 < x < 2$."

"4. A process for producing a sputtering target, which comprises forming an undercoat made of a metal or alloy on a substrate, and forming a ceramic layer as a target material on the undercoat, wherein the ceramic layer as a target material is formed by water plasma spraying wherein a ceramic powder which is reduced by heat-treatment in an inert atmosphere, is transported and deposited onto the undercoat by the water plasma, and, as the target material, a target material comprising a metal oxide of the chemical formula MO_x as the main component, is used, wherein MO_x is a metal oxide which is deficient in oxygen as compared with the stoichiometric composition, and M is at least one metal selected from the group consisting of Ti, Nb, Ta, Mo, W, Zr and Hf, wherein in said MO_x , when M is Nb and/or Ta, x is within

a range of $2 < x < 2.5$,
when M is Mo and/or W, x is within a range from $2 < x < 3$,
and when M is at least one metal selected from the
group consisting of Ti, Zr and Hf, x is within a range
of $1 < x < 2$."

"8. A method for forming a film having a high
refractive index by sputtering, wherein, as a
sputtering target, the sputtering target as defined in
any one of Claims 1 to 3 is used."

III. The following documents are cited in the present
decision:

of the opposition proceedings:

- D1/E2 = JP-A-06 330 297 (including English translation)
- D4/E7 = JP-A-62 161 945 (including German translation)
- D5 = JP-A-05 214 526 (including English translation)
- D6 = JP-A-05 222 528 (Including English translation)
- D7 = JP-A-03 218 821
- D8 = US-A-5 354 446
- D9 = JP-A-07 138 745 (including English translation)
- D11 = JP-A-07 233 469 (including English translation)
- D13/E9 = DE-C-23 00 422
- E1 = JP-A-06 051 110 (including English translation)
- E3 = Salmang/Scholze, "Die physikalischen und chemischen Grundlagen der Keramik", 5th

- edition 1968, pages 374-377 and 396-499
- E4 = Brockhaus abc "Physik", 1973, page 1171
- E5 = DE-A-41 15 663
- E8 = Ohmori et al, "Electrical conductivity of plasma-sprayed titanium oxide (rutile) coatings", Thin Solid Films, 201 (1991), pages 1-8

Filed in the appeal proceedings:

- A23 = Statement of claim before the Landgericht Düsseldorf dated 27 December 2010
- Annex I = "Soda Handbook", Japan Soda Industry Association, 1975, pages 38 and 39
- Annex Ia = partial English translation of Annex I
- Annex II = revised English translation of D1/E2
- Annex III = S. Mitsuda, Kinzoku, December 1985, pages 10-13
- Annex IV = Van der Pauw method, from Wikipedia

IV. The two oppositions had been filed against the patent in its entirety under Article 100(a) EPC, for lack of novelty and inventive step (opponents I and II), under Article 100(b) EPC, that the patent does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by the person skilled in the art (opponent II), and under Article 100(c) EPC for extending beyond the content of the application as originally filed (opponent II).

The Opposition Division held that claim 5 as granted according to the main request met the requirements of Articles 123(2) and 100(c) EPC and of Article 100(b) EPC.

The Opposition Division considered that the priority of the patent in suit was invalidly claimed in view of the purported real first filing (D11) relating to the same invention as claim 1 of the then main request.

Furthermore, the subject-matter of claim 1 of the main request lacked novelty over D11. The late filed document E8 was not admitted into the proceedings in accordance with Article 114(2) EPC. Claim 1 of the first auxiliary request was considered to comply with Article 84 EPC and its subject-matter to be novel, particularly with respect to D11, D1/E2, D4/E7 and E5. Furthermore, the subject-matter of claim 1 of the auxiliary request was considered to involve inventive step in view of D4/E7 and D1/E2, and combinations of E5 and D7, or E5 and D1/E2, E5 and D4/E7, E1 and D4/E7, D9 and D4/E7, D9 and E5, or D9 and D7. Claims 4 and 5 of the first auxiliary request were considered to be novel and to involve an inventive step in view of E1 and the common general knowledge of E3 and E4, and combinations of D1/E2, D4/E7 and D5, or D1/E2 and D5, D6 or D8. As a result the patent could be maintained in amended form.

- V. With letter dated 26 April 2011 appellant II responded to the reply to the grounds of appeal and requested that the appeal proceedings be expedited in view of the fact (see A23) that the respondents and it are involved in infringement proceedings before the Landgericht Düsseldorf in connection with the patent in suit. It further submitted for the first time arguments with respect to the ground of opposition under Article 100(c) EPC, a new novelty objection based on D4/E7 and new argumentation lines of lack of inventive step of the different independent claims in combination with new documents.

VI. With a communication dated 11 July 2011 and annexed to the summons to oral proceedings the Board presented its preliminary opinion with respect to the claims 1-8 of the patent as to be maintained.

It stated amongst others that the admissibility of the intended change of appellant II's case as presented with its letter dated 26 April 2011 needed to be discussed.

With respect to the issue of novelty it appeared that claim 1 lacked novelty over the intermediate product of the process described in D13/E9.

The Board remarked with respect to the issue of inventive step amongst others that D4/E7 appeared to represent the closest prior art and that starting from this there appeared to exist no prejudice against water plasma spraying oxygen deficient metal oxide materials so that it appeared that the person skilled in the art would arrive without any inventive skill at the subject-matter of claims 1 and 4.

With respect to process claim 3 it would be discussed whether or not the person skilled in the art, particularly in view of E8 (brought up again by appellant II), had a conclusive reason to change from water plasma spraying to ordinary plasma spraying in order to reduce the metal oxide during plasma spraying.

VII. With letter dated 15 November 2011 the respondents maintained their main request and submitted the 1. to 11. auxiliary requests in combination with arguments

concerning the allowability of the amendments made as well as the patentability of the subject-matter of the main and auxiliary requests, partly taking account of the Board's comments in the summons. Furthermore, they submitted five new documents (making up annexes I, Ia, II, III and IV). They further requested that three accompanying persons should be allowed to make oral statements on technical issues at the scheduled oral proceedings.

With letter dated 15 November 2011 appellant II, taking account of the Board's comments in the summons, submitted further arguments with respect to the admissibility of the change in its case, the inadmissible amendments, and lack of novelty and inventive step.

- VIII. With fax dated 28 November 2011 appellant I informed the Board that it would not be attending the oral proceedings and requested a decision according to the state of the file.
- IX. With letter dated 7 December 2011 submitted by fax on the same day appellant II requested that the eleven auxiliary requests and the five new documents should not be admitted into the proceedings and that the request to allow oral statements by three accompanying persons be rejected and submitted corresponding arguments in support.
- X. Oral Proceedings before the Board were held on 15 December 2011. Although having been duly summoned appellant I did not attend the oral proceedings, as announced with its letter dated 28 November 2011. In

accordance with Rule 115(2) EPC and Article 15(3) RPBA the proceedings were continued without that party. To start, the requests of appellant II not to allow the oral presentations of the three technical experts nominated by the respondents, not to admit the five newly filed documents and not to admit the 1. to 11. auxiliary requests were discussed.

This was followed by the issue of Article 100(c) EPC with respect to process claim 4 of the present main request. Thereafter admissibility of the amendments made, as well as novelty of the subject-matter of product claim 1 of the main request was discussed with respect to D13/E9.

This issue was followed by discussions of novelty and inventive step of claim 1 of the 1. auxiliary request, particularly with respect to D4/E7, D1/E2, and E8. As a consequence of this discussion the admissibility of the amendments made to and inventive step of product claim 1 of the 2. auxiliary request was discussed, with respect to D4/E7, E8 and D5 (or D8). As a result of this discussion the 3. auxiliary request dated 15 November 2011 was withdrawn by the respondents who then filed an additional 4. auxiliary request being restricted to the two process claims for producing the target.

Then the admissibility of the amendments made to and inventive step of the subject-matter of product claim 1 of the 4. auxiliary request were discussed. Finally, the admissibility of the amendments made in the additional 4. auxiliary request and inventive step of the subject-matter of process claims 1 and 2 of this

request were discussed, particularly with respect to a combination of D4/E7 and E8 with D5 (or D8).

(a) The appellants I and II requested (appellant I in the written proceedings) that the decision under appeal be set aside and that the patent be revoked.

(b) The respondents requested that the appeal be dismissed, or alternatively that the decision under appeal be set aside and the patent be maintained on the basis of one of the following requests:

1., 2. and 4. auxiliary requests as filed with letter dated 15 November 2011;

4. auxiliary request filed at the oral proceedings;
and

5. to 11. auxiliary requests as filed with letter dated 15 November 2011.

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

XI. Claims 1, 3 and 4 of the 1. auxiliary request differ from those of the main request in that the feature "**cylindrical**" has been introduced therein so that claim 1 reads: "A sputtering target comprising a **cylindrical** substrate and a target material formed on the cylindrical substrate ..." while claims 3 and 4 were amended to read: "A process for producing a sputtering target, which comprises forming an undercoat made of a metal or alloy on a **cylindrical** substrate ...".

XII. Claim 1 of the 2. auxiliary request differs from that of claim 1 of the 1. auxiliary request in that a

feature concerning an undercoat has been introduced so that claim 1 reads: "A sputtering target comprising a cylindrical substrate, **an undercoat made of a metal or alloy formed on the cylindrical substrate**, and a target material formed on the cylindrical **substrate undercoat** ..." (amendments compared to claim 1 of the 1. auxiliary request are in bold; emphasis added by the Board):

- XIII. Claim 1 of the 4. auxiliary request differs from claim 1 of the 2. auxiliary request in that the feature "**has a thickness of from 2 to 10 mm, and**" has been introduced between the features "... wherein the target material" and "comprises a metal oxide of the chemical formula MO_x ...". The identical feature has been introduced into process claims 3 and 4 of this 4. auxiliary request between the features "... ceramic layer as a target material" and "is formed by water plasma spraying wherein ...".
- XIV. Claims 1 and 2 of the additional 4. auxiliary request filed at the oral proceedings of 15 December 2011 are identical with the independent process claims 3 and 4 of the 4. auxiliary request.
- XV. Claim 1 of the 5. auxiliary request differs from claim 1 of the 4. auxiliary request in that the following process features taken from process claim 3 have been added at the end: "**which comprises forming an the undercoat made of a metal or alloy on the cylindrical substrate, and forming a ceramic layer as a the target material on the undercoat, wherein the ceramic layer as a the target material is formed by plasma spraying wherein a ceramic powder which is made**

in a semi-molten state in a high temperature plasma gas in a reducing atmosphere, is transported and deposited onto the undercoat by the plasma gas".

XVI. Claim 1 of the 6. auxiliary request differs from claim 8 of the main request in that features concerning the target material and the sputtering atmosphere have been introduced so that last feature reads: "... as a sputtering target, ~~a the~~ sputtering target **comprising a substrate and a target material formed on the substrate, wherein the target material comprises a metal oxide of the chemical formula MO_x as the main component, wherein MO_x is a metal oxide which is deficient in oxygen as compared with the stoichiometric composition, and M is at least one metal selected from the group consisting of Ti, Nb, Ta, Mo, W, Zr and Hf, wherein in said MO_x , when M is Nb and/or Ta, x is within a range of $2 < x < 2.5$, when M is Mo and/or W, x is within a range from $2 < x < 3$, and when M is at least one metal selected from the group consisting of Ti, Zr and Hf, x is within a range of $1 < x < 2$,** is used in an argon atmosphere or in a mixed atmosphere of argon and a small amount of O_2 under a pressure of from 1×10^{-3} to 1×10^{-2} Torr by supplementing the oxygen deficient as compared with the stoichiometric composition, wherein the sputtering target is produced by a spraying method".

XVII. Process claim 1 of the 7. auxiliary request differs from that of the 6. auxiliary request in that the metal M has been limited to "Ti".

- XVIII. Process claim 1 of the 8. auxiliary request differs from that of the 6. auxiliary request in that the feature "in an argon atmosphere ... produced by a sputtering method." has been replaced by the feature "**, wherein the sputtering target is produced by a spraying method, and wherein the oxygen proportion in the sputtering gas is 0 to 30%.**"
- XIX. Process claim 1 of the 9. auxiliary request differs from that of the 6. auxiliary request in that in analogy to product claim 1 of the 4. auxiliary request (see points XI to XIII above) the definition of the target has been amended by incorporating the features of the "**cylindrical**" substrate having "**an undercoat made of a metal or alloy formed on the cylindrical substrate**" and that the target material "**has a thickness of from 2 to 10 mm, and**".
- XX. Process claim 1 of the 10. auxiliary request differs from that of the 9. auxiliary request in that the metal M has been limited to "**Ti**".
- XXI. Process claim 1 of the 11. auxiliary request differs from that of the 9. auxiliary request in that the feature "in an argon atmosphere ... produced by a sputtering method." has been replaced by the feature "**, wherein the sputtering target is produced by a spraying method, and wherein the oxygen proportion in the sputtering gas is 0 to 30%.**"
- XXII. Appellant I argued in the written proceedings, insofar as relevant for the present decision, essentially as follows:

The subject-matter of claims 1, 3 and 4 of the patent as to be maintained lacks inventive step over a combination of the teachings of D4/E7 and E8 also in the light of the newly submitted document D13/E9. The problem to be solved is the provision of an electroconductive sputter target which can be formed in any shape and which is capable of forming a high refractive index film at high speed with DC sputtering, and the provision of processes for manufacturing such targets and a process for forming a high refractive index film using such targets (see patent, paragraph [0014]).

It is not understood as to why the Opposition Division refused to introduce the relevant E8 into the proceedings since it discloses that plasma spraying of titanium oxide layers onto stainless steel results in electroconductive TiO₂ coatings having an increased conductivity with increased oxygen deficiency (see page 1; page 5, point 3.3). The adjustment of an oxygen deficiency is nothing else than a de-oxidation and E8 teaches the person skilled in the art that a sub-stoichiometric composition results in a significant change of the properties of the electrical conductivity, which can be produced by plasma spraying said conductive TiO₂-layers onto a metal (steel) (see pages 1-3).

Claim 3 is also rendered obvious by a combination of the teachings of D4/E7 and E8. According to D4/E7 a sputter target is produced by applying a powdered material by water plasma spraying onto a metallic substrate. Claim 3 differs from the process of D4/E7 only in that the powdered material is heat treated in

an inert atmosphere and that the metal oxide has an oxygen deficiency compared to the stoichiometric composition but these features can be derived from E8 which teaches to carry out a heat treatment with low oxygen pressure or hydrogen atmosphere, i.e. reducing atmosphere, to obtain said oxygen deficiency (see page 1).

XXIII. Appellant II argued, insofar as relevant for the present decision, essentially as follows:

The legal framework for allowing oral statements by accompanying persons has been set by the Enlarged Board of Appeal in G 4/95 (OJ EPO 1996, 412). The announcement in the respondents' letter dated 15 November 2011 does not comply with the requirements as set out in G 4/95 since neither the qualification of these persons nor the subject-matter of their proposed oral submissions has been indicated. It would be unfair to allow this request since appellant II could arrange at short notice only for one technical expert who could in any case not sufficiently prepare himself in advance, contrary to the experts of the respondents since the subject-matter they would be presenting is still unknown. Furthermore, no reasoning has been given at all as to why this request was filed only at such a late stage.

The respondents have not given any reason as to why the eleven auxiliary requests could not have been filed earlier than one month before the scheduled oral proceedings. The respondents neither reacted to the appellant II's second letter based on the infringement case nor to the Board's communication. Each request

comprises features taken from the description which have to be examined for Articles 84 and 123(2) EPC. The feature "cylindrical" of the 1. auxiliary request is unclear in view of the round plates according to the examples 8-11. "Surface roughening" is a process feature and it is unclear how such a surface-roughened surface can be distinguished from a normal rough surface. The "undercoat" features of the 4. auxiliary request are disclosed only in the context of the thermal expansion between the ceramic layer and the substrate (see patent, paragraph [0040]). The product-by-process feature of claim 1 of the 5. auxiliary request was never subject of the examination and opposition procedures and it is not plausible how can it be afterwards determined that the target coating was sprayed in a reducing atmosphere. Claims 1 of the 6. to 11. auxiliary requests are directed to a method for forming a film which subject-matter was never examined, nor part of the first instance in opposition proceedings. The process features thereof are taken from example 28 so that Article 123(2) EPC is at stake and clarity problems ("a small amount of oxygen": which percentage of the oxygen proportion in the 8. and 11. auxiliary requests is meant) arise. Only claim 1 of the 8. auxiliary request has been presented before the first instance but has not been discussed. Furthermore, these requests have not been substantiated. Therefore these requests should not be admitted into the proceedings taking account of Article 12(2) RPBA and of the established case law in this respect.

The new five documents were likewise filed only one month before the scheduled oral proceedings without giving any reason as to why they could not have been

filed earlier. In particular, within the available short time the new translation of E2, which has not been certified as required by Rule 5 EPC, could not be verified and compared with the two other translations thereof already on file for six years. Appellant II did not have the time necessary for translating these new documents on its own. It is obvious that the respondents intend to exchange a translation which is unfavourable to their case by one which fits better. Annex III is only a Japanese document for which no translation has been submitted and the short translated passage taken out of its context could not be verified. Therefore these documents should also not be admitted into the proceedings.

The omission of the features of a "semi-molten state" of the ceramic powder and the plasma spraying "in a reducing atmosphere" from the subject-matter of independent process claim 4 of the main request is not directly and unambiguously derivable starting from process claim 6 of the application as originally filed and thus represents an inadmissible extension which contravenes Article 100(c) EPC. The "semi-molten state" of the powder is necessary to obtain an adherent coating on the substrate, particularly on cylindrical ones.

The subject-matter of claim 1 of the main request contains no limitation with respect to a minimum conductivity or any sputtering process and thus lacks novelty over the electrode obtained in an intermediate step of the process of D13/E9. There is no need that claim 1 of the main request has to be interpreted in the light of the description since claim 1 is not

unclear and therefore can be taken as it is. The above mentioned intermediate electrode comprises all structural features since the TiO_x coating is applied by plasma/flame spraying in a reducing atmosphere and therefore should also be suitable for the purpose of sputtering. The patent in suit does not disclose any further step performed or any other particularities besides said spraying of the oxide material and thus no difference can be seen between the result of the process of the patent in suit and that according to D13/E9 for making a dimensionally stable anode (DSA). If the plasma or flame spray *per se* does not result in such a coating then the patent in suit does not sufficiently disclose the invention. D13/E9 does not relate to any "skeleton" form but only to a titanium body (see claim 1). The "permelec electrode" (= DSA) according to annex I/Ia is not the only electrode for this purpose; there exist other electrode types as well as other manufacturers. The rods 5 are the active electrodes of the DSA (see annex I, figure 1.10).

The alleged problem of out-gassing of the electrode according to D13/E9 when used for sputtering due to a porosity of its coating is not credible. First of all, it should likewise occur with sintered sputter targets which have a higher porosity, but such problems are not known therefrom. Secondly, since the identical spraying method has been used the same problem should in any case occur with the sputter targets of the patent in suit. Furthermore, a degassing step before the sputtering is made if necessary and there exist many different sputter processes ranging over six decades of pressure, including ion beam sputtering or sputtering without magnetron at higher pressure.

The subject-matter of claim 1 of the 1. auxiliary request also lacks novelty over the intermediate product of the process of D13/E9 since such grid-like electrodes are typically in the form of rods or tube-like elements as shown in figure 1.10 of annex I, corresponding to the claimed cylindrical substrate. The disclosure of D4/E7 is not considered to be novelty destroying for this claim 1.

Claim 1 of the 1. auxiliary request is restricted neither to a certain conductivity nor to DC sputtering and lacks inventive step over a combination of the teachings of D4/E7 and the scientific publication E8 published in the well known journal "Thin Solid Films". The person skilled in the technical field of coating knows this publication. It is not possible to apply coatings in the nm-range by the plasma spraying method according to E8 which uses a particle size of 10-44 μm (see page 2). The Van der Pauw method (see page 3 and figure 2) is not restricted to such coatings in this nm-range. This conductivity measuring method only eliminates the effect of the geometry of the sample, but is not limited to thin films.

The plasma spraying processes of E8 and D4/E7 are very similar and are differentiated only by the plasma gases used. To produce the coating on a cylindrical substrate is not inventive since basically there are only planar and cylindrical targets used; the latter ones as such are known (see e.g. D5 or D8).

Claim 1 of the 2. auxiliary request additionally defines a well known undercoat layer, which however

belongs to the common general knowledge of the skilled person. It deals with a second partial problem, i.e. to improve the adhesion of the plasma sprayed material to the substrate and to avoid peeling. D5 (see paragraph [0014]) and also D8 (see abstract) disclose how to prevent the thermal mismatch between a sprayed ceramic target material and the cylindrical substrate (compare also the patent in suit, paragraph [0031]).

Claim 1 of the 4. auxiliary request lacks inventive step as well since D4/E7 suggests a thickness of 6 mm for the sputter target (see examples) and mentions that the melting with a solder material is not necessary due to the application by plasma spraying (see pages 6 and 7, page bridging paragraph). Likewise D5 discloses a thickness of the target of 2-5 mm (see paragraph [0029]). There is no link between the thickness of the coating and the undercoat material. Exfoliation of the ceramic coating does not only occur with DC sputtering and claim 1 is also not restricted in that manner.

The additional 4. auxiliary request should be dismissed for its belated filing and for contravening Article 123(2) EPC since the thickness claimed is only disclosed in connection with the specific solution offered by the undercoat regarding the difference in thermal expansion (see patent, paragraphs [0039] and [0040]). The latter, however, is not defined in this claim.

In any case the process of claim 1 of this additional 4. auxiliary request lacks inventive step for the same reasons as the claimed product which is obtained by plasma spraying in a reducing atmosphere of argon and

hydrogen (see E8, page 2, second paragraph from the bottom). Sputtering targets normally have a thickness in the range of 2-10 mm and all the person skilled in the art has to do, is to plasma spray longer in order to obtain a coating thickness of 6 mm according to D4/E7 (see e.g. example 2). There exists no reason which would hinder the skilled person from doing so.

XXIV. The respondents argued, insofar as relevant for the present decision, essentially as follows:

The respondents are only defendants in the appeal proceedings, in which arguments from the infringement case should not be an issue. The one month time limit set by the Board for filing requests has been respected with the letter dated 15 November 2011. The technical experts were announced therein, in case technical issues would make it necessary to hear them.

The eleven auxiliary requests are a direct response to the Board's communication and the amendments made therein are not totally unpredictable, see e.g. the 1. auxiliary request wherein the feature of former granted claim 6 has been incorporated into the independent claims. The basis of the amendments was given in the above mentioned letter (see sections 2 to 2.12). The amendments were also substantiated therein, see sections 5.1 to 5.1.2 for the 1. auxiliary request and section 5.2 for the 1. to 5. auxiliary requests, and section 5.2.4 for the 6. to 11. auxiliary requests.

The features concerning the surface roughness and the coating thickness are related to the undercoat (see in the patent in suit, paragraphs [0031] and [0040]). The

applied undercoat relieves the problem of the thermal expansion so that the specific features related thereto need not be incorporated. It is admitted that the 6. to 11. auxiliary requests are limited to a method of forming a film and that some of the requests are supplemented by features taken from the description. This method, however, was always in discussion in the proceedings. The pressure range of these claims is taken from paragraph [0045] of the patent in suit and clarifies said "small amounts of oxygen". The percentage defined in claims 1 of the 8. and 11. auxiliary requests should be the usual volume percent (see patent, table 2).

The new five documents were also filed within the given time limit to support the submitted arguments. A translation of the indicated passage of annex III is given on page 15 of the letter dated 15 November 2011. The translations from the Japanese language are correct.

The objection with respect to claim 4 of the main request under Article 100(c) EPC should have been presented in the grounds of appeal. The basis for this process claim, added in examination, which allows to produce targets in any shape, is page 13, line 26 to page 14, line 22 (corresponding to paragraph [0042] of the patent in suit). Since this objection is *prima facie* not relevant (see the Board's communication point 3.1) it should not be admitted.

The electrode produced according to the method of D13/E9 comprises a metallic skeleton and is used for the mercury electrolysis which involves the evolution of chlorine. Therefore said electrode has no continuous

smooth surface but has a mesh structure which by nature is not suitable for sputtering. Furthermore, its applied titanium oxide coating has a fine porosity (see column 3, line 43) so that atmospheric gas is included therein which due to out-gassing would also prevent the use as a sputtering target. Out-gassing would result in an abnormal discharge and the shut-down of the sputtering process. Only the gases of the surface layer can be removed by evacuation before any use in a sputtering process. The claimed target is uniform and highly dense (see patent, paragraph [0083]) and is used for later applying high quality thin oxide films on architectural glass.

D13/E9 does not disclose any cylindrical substrate target. The subject-matter of claim 1 of the 1. auxiliary request is therefore novel.

Product claim 1 of the 1. auxiliary request involves inventive step in view of the basic problem of providing a sputtering target having appropriate electrical conductivity so that it can be used for DC sputtering and having high utilization efficiency (see patent, paragraphs [0014] and [0052]).

D4/E7 discloses the water plasma spraying of stoichiometric oxides (see e.g. example 1) which are non-conductive and cannot be DC sputtered. D4/E7 compares its plasma sprayed materials to sintered materials having a relatively low density of 40-70%. The advantages of D4/E7 compared to the sintering method apply only to ZrO_2 having a very high melting point and a special phase transformation but not to TiO_2 . The person skilled in the art would not combine its

teaching with that of E8 which, taking account of the mentioned Van der Pauw conductivity measuring method (see page 3), which is related only to very thin coatings in the 10 nm-range. Furthermore, E8 is silent with respect to sputter targets but mentions only electronic and electrical industries (see page 1, second paragraph from bottom). Hence the appellants' arguments are based on an *ex-post facto* analysis.

Product claim 1 of the 2. auxiliary request involves inventive step. The claimed coating should be usable on a rotating target without exfoliation at high currents of DC sputtering to be applied. This exfoliation occurs more easily with cylindrical targets. According to E8 there seems to be an Al₂O₃ undercoat to isolate the conducting coating (see figure 2) while according to D4/E7 the coating can be directly applied (see page 6, last paragraph). There exists a synergistic effect for DC sputtering and not a division into independent problems.

Process claim 1 of the additional 4. auxiliary request in comparison to product claim 1 of the 4. auxiliary request further defines the semi-molten state of the ceramic powder during its plasma spraying. Starting from D4/E7 the person skilled in the art would not apply an undercoat layer in view of E8 and would also not apply a layer as thick as in the range of from 2-10 mm. There is no indication in E8 to produce thicker films and a particle size of 10-44 µm has nothing to do with the film thickness. Furthermore, E8 is dedicated to crystalline coatings which implies stress in the coating layer.

Reasons for the Decision

1. *Expediting the appeal procedure*

As the reasons submitted by appellant II with letter of 26 April 2011 are considered sufficient by the Board, it has accelerated the proceedings.

2. *Procedural matters*

Admissibility of oral presentations of technical experts

2.1 According to the decision G 4/95 (*supra*) oral submissions by an accompanying person in opposition or opposition appeal proceedings cannot be made as a matter of right, but only with the permission of and under the discretion of the board. When exercising its discretion the main criteria to be considered are:

i) the professional representative should request permission for such oral submissions to be made. The request should state the name and qualifications of the accompanying person, and should specify the subject-matter of the proposed oral submissions;

ii) the request should be made sufficiently in advance of the oral proceedings so that all opposing parties are able to properly prepare themselves in relation to the proposed oral submissions;

iii) a request which is made shortly before or at the oral proceedings should in the absence of exceptional

circumstances be refused, unless each opposing party agrees to the making of the oral submissions requested;

iv) the EPO should be satisfied that oral submissions by an accompanying person are made under the control of the professional representative (see G 4/95 (*supra*), headnote and point 10 of the reasons).

- 2.2 In their letter dated 15 November 2011 the respondents requested that three persons should be allowed to make oral statements on technical issues at the scheduled oral proceedings, if necessary and stated their names and functions in the company of the patent proprietor.

In said letter the respondents failed, however, to state the qualifications of these three persons and to specify the subject-matter of their proposed oral submissions. The respondents' request for these oral submissions thus does not comply with criteria i).

Even at the oral proceedings the respondents did not explain on which technical subject-matter these three experts should address the Board.

- 2.3 Irrespective of the question whether the date of filing the request (with letter of 15 November 2011) allowed the other parties sufficient time to themselves come up with any required expert(s), the fact that neither the qualifications, nor the subject-matter of the proposed oral submissions were made known shifts an unknown and unwarranted burden onto the opposing parties (i.e. the two appellants), considering the subject-matter and its complexity of the present case. The Board therefore concludes that also criteria ii) has not been met.

2.4 Since none of the two appellants (appellant I has not reacted to the respondents' letter dated 15 November 2011) agreed to the making of the requested oral submissions also criteria iii) has not been met.

2.5 Taking account of the above considerations, in exercising its discretion and in order to guarantee a fair proceedings, the Board therefore refuses this respondents' request.

*Admissibility of the 1. to 11. auxiliary requests
(Articles 12(2), 13(1) and 13(3) RPBA)*

2.6 On 15 November 2011, exactly one month prior to the date of the scheduled oral proceedings before the Board, the respondents filed eleven auxiliary requests.

2.6.1 According to Article 12(2) RPBA the statement of grounds of appeal and the reply thereto shall contain a party's complete case. Any amendment to a party's case after it has filed its grounds of appeal or reply may be admitted and considered at the Board's discretion which shall be exercised in view of inter alia the complexity of the new subject-matter submitted, the current state of the proceedings and the need for procedural economy (Article 13(1) RPBA).

Amendments sought to be made after oral proceedings have been arranged shall not be admitted if they raise issues which the Board or the other party or parties cannot reasonably be expected to deal with without adjournment of the oral proceedings (Article 13(3) RPBA).

In exercising this discretion the boards amongst others consider the following criteria (see Case Law of the Boards of Appeal, 6th edition 2010, chapters VIII.E.16.1 to VIII.E.16.5):

i) there should be some justification for the late filing,

ii) the subject-matter of the new claims should not diverge considerably from the claims already on file, in particular they should not contain subject-matter which has not previously been claimed.

2.6.2 During the entire written appeal proceedings the respondents argued that the technical problem underlying the patent in suit was the provision of an electroconductive sputtering **target** which can be formed into any desired shape and which is capable of forming a high refractive index film at high speed by DC sputtering, **a process for its production** and **a method using such a target** for forming a high refractive index film and all independent claims according to the main request defined only features of the sputtering target *per se* or process steps for making the same.

2.6.3 Then, with their letter dated 15 November 2011 eleven auxiliary requests were filed by the respondents among which the product and process claims according to the 1. to 4. auxiliary requests define further features of the sputtering target (see points XI to XIII above).

"Target" claim 1 of the 5. auxiliary request is now worded as **product-defined-by-its-process of manufacture claim** (see point XV above).

The single "method" claims of the 6. to 11. auxiliary requests now define further features of their **process for forming the high refractive film** under specific process conditions (see points XVI to XXI above).

The respondents, trying to justify these amendments, argued that all these auxiliary requests would be a direct reaction to the Board's communication.

- 2.6.4 The Board cannot follow the respondents in this for the 5. to 11. auxiliary requests.

Although the amendments therein are considered to be briefly substantiated the new claims 1 of these auxiliary requests bring up issues which have never been discussed before, such as which distinction in the final target results from the production process, and issues now relating to the method of forming a film, independent of the target used.

Even at the oral proceedings the respondents have not explained to the Board what a product claim 1 worded as a product-by-process claim could bring in the present case over the original product claim. In particular, when asked by the Board, they could not explain how a sputtering target obtained by water plasma spraying a coating of pre-reduced TiO_x powder could be distinguished from a(n) - apparently identical - product obtained by plasma spraying the same TiO_x

coating but using TiO_2 as the starting powder in a reducing atmosphere.

As concerns the 6. to 11. auxiliary requests, now with only claims for "a method for forming a film" which are further restricted by features of the forming method, but not by features of the target, the debate clearly diverges into a direction hitherto never discussed, nor initiated by the Board.

Furthermore, the amendments made to the claims of the 5. to 11. auxiliary requests initiate a new debate about whether there exists a clear and unambiguous basis for the amendments made therein (Article 123(2) EPC) and whether all the amendments taken from the description comply with Article 84 EPC.

From the above the Board concludes that above conditions i) and ii) are not fulfilled for the 5. to 11. auxiliary requests.

2.6.5 For the Board the examination and discussion of these issues would require an adjournment of the oral proceedings which it is not willing to accept. Therefore, it decides pursuant Article 13(3) RPBA not to admit into the present appeal proceedings the 5. to 11. auxiliary requests.

2.6.6 With respect to the 1. to 4. auxiliary requests the Board notes that the feature "cylindrical" incorporated into claims 1, 3 and 4 of the 1. auxiliary request was present in dependent process claim 6 as to be maintained (although formally having been taken from the description for claim 1); the additional feature

relating to the "undercoat" of product claim 1 of the 2. auxiliary request (although formally having been taken from the description for claim 1) was already present in process claims 3 and 4 as to be maintained; the feature "surface roughened" incorporated into claims 1, 3 and 4 of the 3. auxiliary request was present in dependent process claim 7 as to be maintained (although formally having been taken from the description for claim 1); while the additional feature defining the "thickness" of the target material coating was taken from the description for all claims of the 4. auxiliary request.

These amendments were also briefly substantiated in points 5.1.2 and 5.2.4 of the respondents' letter dated 15 November 2011 and they do not provoke a "diverging debate", as they still relate to the target and its process of manufacture. Furthermore, these amendments are easily to be understood so that the appellants could reasonably be expected to deal with them and they are considered not to extend the scope of discussion as determined by the impugned decision and the statements of grounds of appeal.

Furthermore, the said feature "cylindrical" is considered to have a clear and precise meaning (even with respect to a 5 mm thick round plate having a diameter of 6 inches), contrary to appellant II's allegation.

- 2.6.7 Taking account of the above considerations and the fact that the 1. to 4. auxiliary requests comply with said criteria i) and ii) the Board admits the 1. to 4. auxiliary requests into the proceedings.

Admissibility of the new 4. auxiliary request (Articles 12(2), 13(1) and 13(3) RPBA)

2.7 As a result of the discussions of inventive step at the oral proceedings before the Board, the respondents withdrew the 3. auxiliary request (see point X above) and filed an additional 4. auxiliary request (see point XIV above) which has been restricted to the two independent process claims of the earlier 4. auxiliary request. They argued that these process claims, when compared with the subject-matter of the deleted product claim, additionally defined the plasma spraying of the coating in the semi-molten state of the ceramic powder.

2.7.1 Appellant II objected to the late filing of this new request since the respondents could have filed it together with the other eleven auxiliary requests and requested not to admit it into the procedure.

2.7.2 The Board considers that the limitation in the additional 4. auxiliary request to only the process of manufacture claims, which are further defined over the product claims by already claimed process features is in the present case an acceptable change in the respondents' case. As the issues addressed in the impugned decision and the statements of grounds of appeal also involved these process claims the scope of discussion is not extended and the appellants can be expected to deal with it.

2.7.3 Taking account of the above considerations and the fact that the additional 4. auxiliary request also complies

with said criteria i) and ii) the Board admits it into the proceedings.

Admissibility of the five new documents

2.8 The respondents submitted five new documents, among which is a complete new English translation of the Japanese document D1/E2. They also include partial translations of other Japanese documents (those of annex III are stated to be provided in their letter dated 15 November 2011, page 15, third paragraph) as well as a Wikipedia description of the Van der Pauw method quoted in E8, likewise exactly one month before the date of the scheduled oral proceedings.

2.8.1 The Board considers it credible that these five documents were submitted as a reaction to its communication in order to support the respondents' arguments concerning novelty and inventive step, particularly with respect to the documents D1/E2, D4/E7, and the newly considered E8 and D13/E9.

2.8.2 Although the Board shares appellant II's view that these documents could have been filed earlier by the respondents it considers that their content is not so difficult to understand that an adjournment of the oral proceedings would be necessary. As concerns the absence of a certificate according to Rule 5 EPC that the translation (annex II) corresponds to the original text: this appears to apply equally to the translation of D1/E2 submitted by appellant II.

2.8.3 The Board therefore decided to admit these five new documents into the proceedings.

3. *Inadmissible extension of claim 4 of the main request
(Article 100(c) EPC)*

3.1 The original ground of opposition of inadmissible extension raised against claim 5 of the patent as granted (now claim 4 of the main request) was directed by appellant II to an entirely different feature of this claim for the first time in its letter dated 26 April 2011, i.e. more than two years after its original grounds of appeal dated 20 January 2009 had been filed in accordance with Article 108 EPC.

3.1.1 In its communication annexed to the summons to oral proceedings the Board remarked that neither the change of the representative of appellant II (moreover within one and the same firm) nor the infringement proceedings (which do not play any role in the present appeal proceedings) appeared to justify such a change in appellant II's case. This is particularly so as the claims - of the now main request - underlying the impugned decision have not been amended and are still the same as those when the two appeals were originally filed.

3.1.2 At the oral proceedings the respondents for the first time objected to this change of appellant II's case which should not be admitted for not being *prima facie* relevant and quoted point 3.1 of the Board's communication as its support.

3.1.3 At the oral proceedings the admittance of this change of appellant II's case and its substance were discussed.

For efficiency reasons the Board decides the issue directly on its substance.

- 3.2 Appellant II argued that the omission of the features of a "**semi-molten state**" of the ceramic powder and the plasma spraying "**in a reducing atmosphere**" from the subject-matter of independent process claim 4 of the main request when compared with original claim 6 represents an inadmissible extension of subject-matter.

- 3.2.1 These arguments cannot hold for the following reasons.

Appellant II appears to start from the premise in the present case that original basis of the second process claim (claim 5 of the patent as granted, now claim 5) may only be had from the single process claim 6 as originally filed, from which deletion of essential features should not be allowed.

The Board considers appellant II to be wrong in this respect, as the description, or even other claims with support from the description, may provide sufficient basis for such an independent claim.

For the comparison with the application "as originally filed", which is a PCT-application in the Japanese language, the Board makes use of the English translation of this PCT application as filed on entry into the European phase (hereafter the "original English application"), with the exclusion of the amended pages filed at that occasion. The appellants have not raised any objections to this approach already applied in the Board's communication accompanying the summons.

Indeed, there exists a clear and unambiguous independent basis for this claim on page 13, line 25 to page 14, line 22, further supported by page 30, lines 14 to 19 (= example 28) of the description. Alternatively it can be clearly and unambiguously derived from the subject-matter of claims 1-4, 6 and 8 in combination with page 13, line 25 to page 14, line 22.

From said passages the person skilled in the art derives immediately that for the plasma spraying there are two alternative methods: one in which a ceramic powder is made in a semi-molten state in a high temperature plasma gas in a reducing atmosphere and one using water plasma spraying a ceramic powder which is previously reduced by heat-treatment in an inert atmosphere. For the latter it is indeed better to use a pre-reduced MO_x material in the production of the sputter target by water plasma spraying - as exemplified by example 28 - since the reducing power of this plasma spraying method is **not** comparable to one using a reducing gas mixture of e.g. Ar/H₂ since its reducing power is weak (see page 14, lines 18 to 22 of the original English application).

- 3.2.2 Furthermore, for the first method it is clear that the (stoichiometric) ceramic powder is made in a semi-molten state in a high temperature plasma gas in a reducing atmosphere and deposited on a substrate so that the sputtering target is directly formed (see page 8, line 16 to page 9, line 10 of the original English application). This passage represents the counterpart to the single independent process claim 6 of the original English application related to the

plasma spraying of (stoichiometric) oxidic ceramic powder which is reduced during the plasma spraying. The second method simply does not have a counterpart original claim, however, this is not a precondition for sufficient basis if the description provides this.

3.2.3 According to the disclosure of the second alternative process (water plasma spraying of the pre-reduced MO_x material) a reducing atmosphere is neither necessary nor suggested since the ceramic powder has already been reduced. It is therefore clear to the person skilled in the art that the semi-molten state of the ceramic powder, is only necessary for the reduction of the oxidic powder material during the plasma spraying operation thereof in the reducing atmosphere (see page 13, lines 6 to 14 of the original English application), but not for the water plasma spraying operation of pre-reduced MO_x material.

3.2.4 The additional argument of appellant II that the semi-molten state of the ceramic powder is necessary in order to obtain a well-adhering deposit on the substrate cannot hold, either.

First of all, it is technically sufficient that the surface of the powder particles is in a semi-molten state or partly molten to produce a well adhering coating, i.e. it is not necessary that the entire powder particles be in a semi-molten state. Secondly, as argued by the respondents, the use of water plasma spraying inherently results in the semi-molten state of the ceramic material on the surface since this method provides a higher energy density as compared with the density of an ordinary gas plasma (see page 14,

lines 11 to 17 of the English translation of the PCT application as originally filed).

- 3.2.5 Consequently, neither the feature "semi-molten state" nor the feature "reducing atmosphere" are presented in the original English application as essential features in the context of the second method, water plasma spraying pre-reduced MO_x powder.

Therefore, even when starting only from original claims 1-4, 6 and 8 of the original English application and then considering these two features "omitted", the above conclusion is fully in line with the criteria set out in decision T 331/87 (OJ EPO 1991, 22) cited by appellant II, as they are neither presented in the description as essential nor are they indispensable for water plasma spraying of pre-reduced MO_x powder.

- 3.2.6 Therefore the method of process claim 4 of the main request is clearly and unambiguously derivable from the application as originally filed so that the new objection under Article 100(c) EPC cannot hold.

4. *Allowability of amendments (Articles 84 and 123(2) and (3) EPC)*

Since the Board comes to the conclusion that the subject-matter of claim 1 of the main request lacks novelty (see point 5 below) and the subject-matter of all the admitted further auxiliary requests lacks inventive step (see point 6 below) there is no need to verify whether or not the claims of these requests or the amendments made therein comply with Articles 84, 123(2) and (3) EPC.

5. *Novelty (Article 54 EPC)*

Claim 1 of the main request

5.1 Product claim 1 of the main request defines a sputtering target *per se* comprising a substrate and a target material, the latter comprises as the main component a metal oxide which is deficient in oxygen and which can be TiO_x , with x being within a range of $1 < x < 2$, and said target material has been produced by a spraying method (see point II above).

The Board concurs with the appellants that claim 1 does not define any structure or shape of the substrate, nor any minimum conductivity of the applied TiO_x coating in order to allow DC sputtering thereof, nor any intended use in DC sputtering. The sputtering target of claim 1 therefore needs to be only slightly oxygen deficient and would thus only be suitable for RF sputtering. Furthermore, claim 1 of the main request does not imply any restrictions with respect to a specific sputtering process, let alone with respect to the quality of the coating to be produced by the sputtering. Any known substrate with a material formed thereon by a spraying method having the claimed composition and being suitable for sputtering may therefore be novelty destroying.

5.2 Document D13/E9 discloses a process for producing an electrolytic electrode by flame- or plasma spraying TiO_{2-x} ($0,1 > x > 0$) onto a metallic structure in an amount of 100 to 6000 g/m², preferably titanium or titanium alloy. Onto this **intermediate product**

comprising the sprayed TiO_{2-x} coating layer then a noble metal compound of ruthenium and/or iridium is applied as a thin film in an amount of 0.5-9.5 wt% (based on said TiO_{2-x}) which is then thermally treated in air atmosphere at 550-700°C to form the noble metal oxides (see claims 1-5; column 3, lines 37 to 65; column 4, lines 41 to 49; examples 1-4 and Table).

According to example 1 of D13/E9 sandblasted Ti-bodies were coated with a thick titanium oxide coating by plasma spraying TiO_2 powder using a mixture of about 1:1 of nitrogen as plasma gas and 80/20 forming gas as the carrier gas for the powder (see D13/E9, column 5, lines 2 to 14).

5.2.1 80/20 forming gas is a mixture of 80 vol.% nitrogen and 20 vol.% hydrogen and thus creates a reducing atmosphere during the plasma spraying of this TiO_2 powder. The resulting plasma sprayed coating on the Ti-body according to D13/E9 is therefore an oxygen deficient TiO_x material which - in analogy to the plasma spraying of TiO_2 powder with a mixture of argon and hydrogen according to example 17 of the patent in suit - with x being between 1.9 and 2.0 is sufficiently conductive (see D13/E9, column 6, lines 55 to 58) to even allow DC sputtering.

5.2.2 Furthermore, the TiO_x coating according to D13/E9 is considered to have the same density and/or porosity as the coating obtained by the plasma spraying process of the patent in suit since the plasma spraying in the reducing atmosphere containing hydrogen must have been carried out likewise in the semi-molten state of the TiO_2 powder. This is due to the fact that the reduction

of the TiO_2 by the hydrogen of the reducing atmosphere took place during the plasma spraying thereof but requires said semi-molten state as is known from the patent in suit (see patent, paragraph [0039]).

In this context it is remarked that the respondents based their arguments with respect to the objection under Article 100(c) EPC on point 3.1 of the Board's communication (see points XXIV and 3.1.2 above) and thereby implicitly acknowledged the above finding. This is due to the fact that point 3.1 of the communication includes the aforementioned finding (corresponding to point 3.2.2 above), i.e. the semi-molten state is **only** necessary when the oxide powder has to be reduced during the plasma spraying.

5.2.3 As a consequence of the above considerations the respondents' arguments concerning any out-gassing caused by the porosity of the TiO_x coating **cannot** be accepted since it should likewise apply to the sputter target of claim 1 of the main request, as the claim does not specify any further features in this respect. Similarly, all other arguments cannot hold either since claim 1 of the main request contains **no** restrictions at all with respect to the sputter target or its intended use in sputtering process(es) (see point 5.1 above).

Likewise the arguments concerning the "skeleton" form of the DSA electrode according to D13/E9 as opposed to the form of the target of claim 1 cannot hold since the subject-matter of claim 1 of D13/E9 is **not** restricted to an electrode for the mercury electrolysis and only defines a metallic structure ("metallisches Gerüst"). This structure could be a simple substrate plate of a

DSA electrode. But even if it is implied that the electrode of D13/E9 has a TiO_x coated mesh structure, e.g. such as the one shown in figure 1.10 of annex I as produced by the respondents, then these coated rods of such a mesh structure together also form a planar surface similar to such a plate, which is considered to be suitable for sputtering.

- 5.2.4 Taking account of the above considerations, the **intermediate electrode** of D13/E9 is considered to be suitable for the use as a sputtering target and allows sputtering of a TiO_x film.

Therefore the subject-matter of claim 1 of the main request lacks novelty over said disclosure in D13/E9. The main request is therefore not allowable.

Claim 1 of the 1. auxiliary request

- 5.3 Product claim 1 of this request now additionally defines that the target comprises a cylindrical substrate (see point XI above).

- 5.3.1 Appellant II argued lack of novelty of the subject-matter of claim 1 of the 1. auxiliary request only over the intermediate product of D13/E9. These arguments, however, cannot hold for the following reasons:

- 5.3.2 A **cylindrical** electrode is in D13/E9 neither explicitly nor implicitly disclosed. D13/E9 is silent with respect to the shape or form of said metallic structure forming the electrode. The appellants' allegation that such mesh electrodes are "typically in the form of rods or tube-like elements" as shown in figure 1.10 of annex I

implies that - untypically - such mesh electrodes can also be formed from elements which e.g. have a rectangular or square or any other non-cylindrical cross section. Hence there exists no clear and unambiguous disclosure of such an embodiment in D13/E9. The embodiment depicted in annex I belongs to a different, second disclosure which according to the consistent case law cannot be read into the disclosure of D13/E9 since there is no specific reference to it nor to this feature (see Case Law of the Boards of Appeal, 6th edition 2010, chapter I.C.3.1).

5.3.3 Taking account of the above, the subject-matter of claim 1 of the 1. auxiliary request complies with Article 54 EPC.

6. *Inventive step (Article 56 EPC)*

The discussion of inventive step is more efficient if the Board first turns to the more limited claim 1 of the 4. auxiliary request.

Claim 1 of the 4. auxiliary request

6.1 The Board comes to the conclusion that claim 1 of the more restricted 4. auxiliary request lacks inventive step over a combination of the teachings of D4/E7, E8 and D8 (or D5) for the reasons that follow.

6.1.1 According to this line of arguments D4/E7 was considered to represent the closest prior art.

D4/E7 discloses a process for the production of large-sized ceramic sputter targets by water plasma spraying

a ceramic powder, e.g. ZrO_2 , Ta_2O_5 or TiO_2 , which is thereby melted and deposited on the substrate with almost the theoretical density of the ceramic substance (see abstract; claims 1 and 2; page 6 of English translation, second full paragraph). Preferably the powder has a particle size of 30 to 80 μm (see page 4, third paragraph and examples 1-3). The plasma sprayed sputter targets according to the examples 1-3 have a coating thickness of 6 mm.

6.1.2 The sputter target of claim 1 of the 4. auxiliary request comprises a cylindrical substrate comprising an undercoat of a metal or alloy and the target material is applied in a thickness of from 2 to 10 mm (see point XIII above) and therefore differs from that of the closest prior art D4/E7 in that

i) an oxygen deficient TiO_x coating with x being in the range of $1 < x < 2$ is applied by (e.g. plasma) spraying in a reducing atmosphere onto

ii) it is a cylindrical substrate, and

iii) an undercoat of a metal or alloy is formed on the cylindrical substrate.

6.1.3 Feature i) solves the problems of obtaining an electrically conductive oxide coating which can be DC sputtered (see patent, paragraph [0016]) while feature ii) has the effect that the target has a higher utilization efficiency than the planar type target (see patent, paragraph [0052]). Feature iii) solves the problem of improving the adhesion between the target material and the cylindrical substrate and avoiding

peeling due to thermal shock (see patent, paragraphs [0031] and [0040]).

Consequently, feature ii) relates to a totally different technical problem than features i) and iii), i.e. a higher utilization efficiency, which is not synergistically linked with the technical problem of providing an electrically conductive sputter target for DC sputtering nor to the problem of adhesion/peeling.

The same holds true with respect to feature iii) which relates to another problem different from the electrical conductivity, i.e. to improve the adhesion of the target material and avoid its peeling. The respondents' statement that there exists a synergistic effect for DC sputtering cannot hold since the patent is silent in this respect and could not be backed up at the oral proceedings when asked by the Board how the oxygen-deficiency of the target material should be linked with the cylindrical form of the substrate. Furthermore, the target of claim 1 of the 4. auxiliary request is in any case not restricted to DC sputtering.

Features i), ii) and iii) are therefore considered to represent a mere aggregation of separate features, solving three independent partial technical problems, which can thus be discussed independently for inventive step.

Therefore, in order to solve the aforementioned partial technical problem with respect to features ii) and iii), other prior art than for feature i) can be taken into account, in accordance with the longstanding practice of the Boards of Appeal (see Case Law of the Boards of

Appeal of the European Patent Office, 6th edition, 2010, section I.D.8.2.2).

6.2 The solution to the **first partial problem** is obvious for the following reasons:

6.2.1 The person skilled in the art being familiar with the production of sputter targets by plasma spraying a ceramic powder such as TiO_2 in order to produce a target material coating is considered to know of the scientific publication E8 published in "Thin Solid Films", which is a well known journal in the technical field of applying coatings, be it by plasma spraying or from sputtering a target via DC sputtering or RF sputtering.

6.2.2 E8 teaches the person skilled in the art that plasma spraying of commercial TiO_2 powder using argon or a mixture of argon and hydrogen as plasma gas results in an electrically conducting oxygen deficient, sub-stoichiometric TiO_x coating (see page 1, first to sixth paragraphs; page 2, third to seventh paragraphs; page 4, figure 4; page 5, last paragraph and page 6, figure 9). According to E8 the TiO_2 powder is plasma sprayed onto stainless steel plates (see page 2, seventh paragraph).

It belongs to the common general knowledge of the person skilled in the art that stainless steel can be used as the substrate material of sputter targets (compare patent, paragraph [0030]).

The Board therefore considers that it is obvious for the person skilled in the art wishing to obtain an electrically conductive target to enable DC sputtering

to use the plasma spraying method of the TiO_2 powder according to E8 instead of the water plasma spraying method of the identical TiO_2 powder according to D4/E7 since it allows him to produce a sputter target having an electrically conducting (sub-stoichiometric TiO_x) target material coating which is suitable for DC sputtering (see E8, page 6, figure 9).

6.2.3 The respondents' arguments to the contrary cannot hold for the following reasons.

E8 cannot produce very thin coatings in the 10 **nm**-range as alleged since the TiO_2 powder used for plasma spraying actually has the (very common) particle size of 10-44 **μm** (see page 2, fifth paragraph) so that the resulting coating is expected to have a thickness which is at least 3-4 magnitudes thicker and not one which is 1000 times thinner.

Furthermore, the Van der Pauw technique mentioned in E8 (see page 3, first paragraph and figure 2) is not restricted to the use of measuring the conductivity of only very thin coatings but only eliminates the influence of the sample geometry and is stated to be applicable to a sample being approximately two-dimensional, i.e. it is much thinner than it is wide (see annex IV, page 1, first paragraph). Consequently, this definition does **not** exclude any coating thickness in the millimetre range intended by the patent (2 to 10 mm), as with sputter targets the other dimensions are anyway sufficiently large.

The fact that E8 does not deal with the production of sputter targets but mentions only electronic and

electrical industries as the field of application is not particularly relevant since E8 is not considered as the closest prior art but only as a further disclosure, which teaches the person skilled in the art how he can produce an electrically conducting oxygen deficient TiO_x material coating by ordinary plasma spraying TiO_2 particles in a reducing gas mixture of argon and hydrogen. This reducing atmosphere allows reduction of these TiO_2 particles during the plasma spraying operation. The process of E8 thus uses the same starting material as D4/E7, i.e. TiO_2 , but a different plasma atmosphere.

The argument that E8 is dedicated to crystalline TiO_x coatings which would imply that stress is present in the coating layer is not acceptable since the same would hold true for the TiO_x coating according to claim 1 of the 4. auxiliary request since it can be applied by the identical method.

The argument that the skilled person would not select the plasma spray method taking account of the advantage of only a small higher density for TiO_2 when compared to an identical sintered target may hold true but at the same time he is also aware of the fact that forming the target by spraying avoids the step of bonding the sintered cylinder body of ceramic material to a target holder material (= substrate) by means of e.g. indium metal (compare e.g. D4/E7, the paragraph bridging pages 6 to 7 and D8, column 4, lines 3 to 7).

It is also well known that the plasma spray method allows producing a target in any desired shape. Therefore it is evident that the person skilled in the

art has the incentive to select the plasma spray method of E8.

6.3 The solutions to the **second partial problem** based on feature ii) and to the **third partial problem** based on feature iii) are also obvious since it is known from the prior art D8 (or D5) for that matter that the use of cylindrical targets has a higher utilization efficiency as compared to the planar type (see e.g. D8, column 10, lines 11 to 14 and D5, paragraph [0060]) while the use of an undercoat of a metal or alloy having a thermal expansion coefficient of an intermediate level between those of the cylindrical substrate and the target material is known to avoid the peeling due to thermal shock by improving the adhesion of a thick target material coating (see also D8, column 3, line 64 to column 4, line 24 and column 6, lines 33 to 55 and D5, paragraphs [0013] and [0014]).

6.3.1 With respect to the cylindrical substrate it is also remarked that for sputtering basically only planar and cylindrical sputter targets are used.

6.3.2 The respondents' arguments to the contrary cannot hold for the following reasons.

Although it is true that according to D4/E7 the coating can be directly applied to the substrate material (see page 6, last paragraph) it is clear that, in case that exfoliation at the high currents of DC sputtering would occur, the person skilled in the art would realize that the thermal mismatch between the ceramic coating and the metallic substrate material is responsible for this exfoliation and would look for a prior art teaching

which deals with this thermal mismatch. D5 or D8 are available to him in the field of cylindrical rotatable targets which in identical manner teach him to foresee an undercoat layer to overcome this problem, with the result that in applying this teaching he would arrive at this subject-matter claimed, as remarked by the Board during the oral proceedings.

It was also argued that the person skilled in the art starting from D4/E7 and already applying the teaching of E8 to achieve an electroconductive layer for the target would not apply an undercoat layer as according to E8 an Al_2O_3 undercoat should be used, which isolates the conducting TiO_x coating from the steel substrate. However, this alumina layer has no relation to the process with which the TiO_2 coating is applied according to E8, nor to the problem of thermal mismatch.

It is also clear that the person skilled in the art in order to produce a sputter target would apply a thick layer in the range of from 2-10 mm, particularly as his starting point D4/E7 already requires a thickness of 6 mm, but also taking account of the teaching in either D5 (see paragraph [0029]) or D8 (see column 7, lines 55 to 57), namely that the applied undercoat layer allows for thicknesses of (at least) 2-5 mm of the ceramic target material.

Even if ceramic coatings on cylindrical substrates without an undercoat layer should be more prone to exfoliation than those on planar substrates the person skilled in the art expects a higher utilization efficiency of the cylindrical ones and therefore has a clear incentive to choose that direction.

6.3.3 Consequently, the subject-matter of claim 1 of the 4. auxiliary request does not involve inventive step and thus does not comply with Article 56 EPC. The 4. auxiliary request is therefore not allowable.

Claims 1 of the 1. and 2. auxiliary requests

6.4 Since claim 1 of the 4. auxiliary request is narrower in scope than claim 1 of the 1. and 2. auxiliary requests (compare points XI to XIII above) the above conclusion with respect to claim 1 of the 4. auxiliary request applies *mutatis mutandis* to claims 1 of the 1. and 2. auxiliary requests.

The Board therefore concludes that their subject-matter does not comply with the requirements of Article 56 either. The 1. and the 2. auxiliary requests are thus also not allowable.

Claim 1 of the additional 4. auxiliary request, filed at the oral proceedings

6.5 Process claim 1 of the additional 4. auxiliary request in comparison to product claim 1 of the 4. auxiliary request (which is already a product-by-process claim: "wherein the sputtering target is produced by a spraying method") further defines that the ceramic layer of e.g. TiO_x is "formed by plasma spraying" and the "ceramic powder ... is made in a semi-molten state in a high temperature plasma gas in a reducing atmosphere" (see point XIV above).

6.5.1 As considered in points 3.2.3 and 5.2.2 above, the semi-molten state of the ceramic powder represents a pre-requisite to obtain the oxygen deficient TiO_x coating by allowing the reduction of the starting TiO_2 powder in the reducing atmosphere during its plasma spraying.

Since the plasma spraying of the TiO_2 powder in the reducing atmosphere according to E8 results in an oxygen deficient TiO_x coating it has to be concluded that also this powder must have been in the semi-molten state.

It is additionally remarked that the semi-molten state of the powder is commonly used in the plasma spraying of ceramic powder as is proven by the prior art D5 (see paragraph [0019]) or D8 (see D8, column 4, lines 25 to 40 and line 67 to column 5, line 3).

6.5.2 The Board therefore holds that the skilled person would arrive at the process of claim 1 of the additional 4. auxiliary request without inventive skills for the same reasons as apply to the target of product claim 1 of the 4. auxiliary request (see points 6.1 to 6.3.3 above) since the process used for producing that target fulfils all the requirements of process claim 1 of the additional 4. auxiliary request.

6.5.3 For the above reasons the subject-matter of claim 1 of the additional 4. auxiliary request lacks an inventive step. This auxiliary request is therefore not allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

G. Nachtigall

H. Meinders