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Datasheet for the decision of 8 March 2013

Case Number: T 1850/08 - 3.4.03

Application Number: 94912385.5

Publication Number: 692138

IPC: H01J 37/34

Language of the proceedings: EN

Title of invention:
Reactive DC sputtering system

Patent Proprietor:
ADVANCED ENERGY INDUSTRIES, INC.

Opponents:
01: von Ardenne Anlagentechnik GmbH
02: HÜTTINGER Elektronik GmbH + Co. KG
03: INTERPANE Entwicklungs- und Beratungsgesellschaft mbH & Co. KG

Headword:
-

Relevant legal provisions (EPC 1973):
EPC Art. 54, 56, 100(a)(c), 123, 104

Keyword:
"Inventive step (affirmed)"
"Repartition of costs (refused)"

Decisions cited:
-

Catchword:
-

Case Number: T 1850/08 - 3.4.03

D E C I S I O N
of the Technical Board of Appeal 3.4.03
of 8 March 2013

Appellant: (Patent Proprietor)	ADVANCED ENERGY INDUSTRIES, INC. 1625 Sharp Point Drive Fort Collins, CO 80525 (US)
Representative:	Gill, David Alan WP Thompson 55 Drury Lane London WC2B 5SQ (GB)
Respondent I: (Opponent 01)	von Ardenne Anlagentechnik GmbH Plattleite 19/29 D-01324 Dresden (DE)
Representative:	Hudler, Frank Lippert, Stachow & Partner Krenkelstrasse 3 D-01309 Dresden (DE)
Respondent II: (Opponent 02)	HÜTTINGER Elektronik GmbH + Co. KG Elsässer Strasse 8 D-79110 Freiburg (DE)
Representative:	Kohler Schmid Möbus Patentanwälte Ruppmannstrasse 27 D-70565 Stuttgart (DE)
Respondent III: (Opponent 03)	INTERPANE Entwicklungs- und Beratungsgesellschaft mbH & Co. KG Sohnreystrasse 21 D-37697 Lauenförde (DE)
Representative:	Körfer, Thomas Mitscherlich & Partner Patent- und Rechtsanwälte Postfach 33 06 09 D-80066 München (DE)

Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted 10 July 2008 revoking European patent No. 692138 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman:	G. Eliasson
Members:	V. L. P. Frank
	P. Mühlens

Summary of Facts and Submissions

I. This is an appeal by the patent proprietor against the decision of the opposition division to revoke the patent No EP 692138 (Article 101(2) EPC).

A first opposition was filed by Opponent I (von Ardenne Anlagentechnik GmbH) against the granted patent to the extent of claims 1-10 on the grounds of lack of novelty and inventive step (Articles 100(a), 54 and 56 EPC 1973) as well as insufficient disclosure (Article 100(b) EPC 1973).

A second opposition was filed by Opponent II (Hüttinger Elektronik GmbH & Co. KG) against the granted patent in its totality on the grounds of lack of inventive step (Articles 100(a), 56 EPC 1973) as well as added subject-matter (Article 100(c) EPC 1973).

A third opposition was filed by Opponent III (INTERPANE Entwicklungs- und Beratungsgesellschaft mbH & Co. KG) against the granted patent in its totality on the grounds of lack of novelty and inventive step (Articles 100(a), 54 and 56 EPC 1973) as well as added subject-matter (Article 100(c) EPC 1973).

II. At oral proceedings before the board, the appellant proprietor requested that the decision under appeal be set aside and that the patent be maintained in amended form in the following version:

- description: pages 2 to 8 filed at the oral proceedings of 8 March 2013;

- claims: 1 to 11 labelled main request, filed with the grounds of appeal;

- drawings figs. 1 to 3 of the patent specification.

The respondent opponents requested that the appeal be dismissed, and apportionment of costs.

The appellant proprietor requested that the request for apportionment of costs be refused.

III. Independent claims 1 and 3 of the main request read as follows (the amendments to the granted claims were highlighted by the board):

"1. A method of reactive sputtering, in which arcing is suppressed or avoided, comprising supplying a **conductive** material target (6) to expose coating material within a coating chamber (2), supplying at least one reactive gas within said coating chamber wherein said gas reacts with said coating material to form electrically insulating material, furnishing direct current power by applying a DC voltage within said coating chamber **from a DC power source** to create a plasma (5) composed of charged particles, and causing deposition of at least some of said electrically insulating material upon a substrate (7) through action of said plasma, characterized by **periodically** reversing said **plasma creating DC** voltage for a time period between 1 and 10 microseconds without extinguishing said plasma, said reversing being effected from every 10 microseconds to every 2000 microseconds by applying a reverse voltage at a level of between 5 and 20 percent of said DC voltage."

"3. A reactive plasma sputtering system, in which arcing is suppressed or avoided, comprising a coating chamber (2), a **conductive** material target (6) disposed to expose coating material within said chamber, a reactive gas supply connected to said coating chamber, wherein said gas reacts with said coating material to form some electrically insulating material, an anode (3) positioned within said coating chamber in proximity to said material target (6), and a DC power source (1) which applies a **DC** voltage across said anode (3) and said material target and which creates a plasma (5) comprised of charged particles, characterized by ~~the provision of~~ **timer circuitry (22) and** voltage reversal circuitry operable to reverse said **plasma creating DC** voltage for a time period between 1 and 10 microseconds every 10 to every 2000 microseconds by applying a reverse voltage at a level of between 5 and 20 percent of said DC voltage **without extinguishing said plasma, wherein said voltage reversal circuitry is responsive to said timer circuitry**."

IV. The following documents are cited in this decision:

OID5 = English translation of JP 02-141572 A

OID6 = JP 02-141572 A

OIID1 = R. A. Scholl, "Process Improvements for Sputtering Carbon and other Difficult Materials using Combined AC and DC Process Power", Society of Vacuum Coaters, 35th Annual Technical Conference Proceedings, 1992, pp. 391-394

OIID5 = US 4,046,659 A

OIID8 = J. H. Greiner and A. Halperin, "RF Sputtering Technique", IBM Technical Disclosure Bulletin, Vol. 17, No. 7, 1974, pp. 2172-2173

V. In the decision under appeal, the opposition division found that:

- The objection of opponent III under Article 100(b) EPC 1973 against claim 1 was unfounded, since in the context of the original application the terms "extinguishing said plasma" and "quenching said plasma" were synonyms (reasons, point 2).

- The objection of opponent III that the subject-matter of claim 1 was not novel over document OID5/OID6 could not be upheld, since the supply of a reactive gas, as claimed, had to be construed as an active method step and did not encompass residual amounts of oxygen as reactive gas arising either from re-sputtering from the SiO_2 film or by unavoidable gas leaks in the sputtering chamber (reasons, point 3.1).

- Document OID5/OID6 was considered as the closest prior art. This document rendered obvious a sputtering method with all the features of claim 1 except reactive sputtering and a reactive gas supply. It disclosed a sputtering method in which arcing was suppressed, since the prevention of charge-up was tantamount to suppressing arcing. According to

claim 4 of OID5/OID6 a waveform as defined in claims 1-3 was applied to the target and according to claim 5 the substrate and the chamber were grounded while applying a voltage waveform to the target. The waveform referred to in claim 5 was clearly the waveform described in the first embodiment on page 9 in which specific pulse durations and relative pulse levels were disclosed. The second embodiment of OID5/OID6 disclosed the use of an insulating target and it was obvious to apply to this target a periodically reversed DC voltage according to the first embodiment. Hence the objective technical problem was seen in depositing an insulating material by an alternative method, instead of using a target of an insulating material as taught in OID5/OID6. An obvious solution was to employ reactive sputtering, an option belonging to the general knowledge of the skilled person. The method of claim 1 hence did not involve an inventive step (reasons, points 3.2-3.5).

VI. The appellant proprietor argued essentially as follows:

- The opposition division misinterpreted the disclosure of document OID5/OID6. In addition, the opposition division used teachings first disclosed by the patent itself when arguing the lack of an inventive step. More particularly, the opposition division used the discovery that a DC generated plasma is not likely to extinguish for a voltage reversal time of 10 microseconds in its discussion of a claim feature that required "without extinguishing said plasma". The prior art however, did not disclose or suggest this discovery. It was

the patent under appeal that provided this knowledge for the first time. Therefore, the opposition division used knowledge, which was only provided by the patent itself, in its reasons for revocation.

- The patent specifically addressed problems occurring in reactive DC sputtering, ie when using a reactive gas for producing an insulating material to be sputtered on the substrate from a metallic, conductive sputter target. Since the reactive gas not only reacted with material intended to be deposited on the substrate, the conductive sputter target was prone to receive an insulating layer in at least some areas. Such insulated areas collected positive charges from the ion bombardment. This charge up lead to arcing, which in turn could cause damage to the substrate to be processed and/or the power source. Reactive DC sputtering was thus highly susceptible to arcing problems, and the patent provided an approach for reactive DC sputtering with less or no arcing.

- OID5/OID6 disclosed a bias sputtering method and apparatus, ie a method and apparatus in which the substrate to be processed also received a voltage in order to increase the step coverage in cases where contact holes or through-holes had an aspect ratio close to one. In a first embodiment OID5/OID6 disclosed the use of a square-wave voltage of different polarities to prevent damage to the substrate due to electron bombardment and charge-up. In a second embodiment forming an insulation film on a substrate by sputtering an insulator target was disclosed. OID5/OID6 stated in this context that a

high frequency had to be applied to the insulator target. The high frequency did not only prevent charge-up of the insulator target, but was necessary to enable electrical power to pass through the insulator target to create the plasma. It did not however disclose to depart from the high frequency approach. Any skilled person, who was aware of the need for high frequency, understood that it simply proposed to change the shape of the high frequency waveform applied to the insulator target, but not the frequency itself. In its third embodiment OID6 combined the ideas of the first and second embodiments, namely applying one of the waveforms disclosed in connection with the first embodiment to the substrate, and applying the high frequency waveform or a conventional high frequency to the target.

- The opposition division inadmissibly combined the timing behaviour disclosed in connection with the bias voltage at the substrate of the first embodiment with the voltage waveform of the second embodiment which required a high frequency and therefore involved a different timing behaviour. OID6 did not disclose or suggest that a plasma could be created and maintained (without extinguishing) by the voltage waveform of the first embodiment.

- The claimed sputtering method and apparatus achieved an insulating coating on a substrate in an inexpensive (due to the use of the inexpensive DC approach in contrast to more expensive AC approaches) and reliable (due to the avoidance of damages through arcing) manner. Starting from the first

embodiment of document OID6, it was an object of the invention to provide a method and a system for generating insulating coatings on substrates in an inexpensive and reliable manner. Document OID6 did not disclose or suggest this solution. In contrast, the second embodiment pointed away by proposing using high frequency and an insulating target instead of a periodically reversed DC voltage and a reactive sputtering process.

- The other documents discussed in the course of the proceedings likewise pointed away from the present invention. In particular, document OIID5 disclosed an AC approach where an alternating potential was established between the two electrodes of the sputtering system. Document OIID8 proposed a purely RF based sputtering approach, i.e. an approach with a completely different timing behaviour. This document further confirmed the teachings of the second embodiment of OID6.

- The request for apportionment of costs should be refused, since the main request was not a totally new request but consisted of further emphasising features already present.

VII. Respondent opponent I argued essentially as follows:

- It was part of the general technical knowledge of the skilled person that in sputtering systems arcing occurred when insulating layers were charged up, independently whether this took place on the substrate or the target. The skilled person would have thus used the voltage waveform of the first

embodiment of OID5/OID6 also in the third embodiment of this document in which "a waveform according to the invention" was applied to the target.

VIII. Respondent opponent II argued essentially as follows:

- Document OID5/OID6 disclosed a sputtering apparatus in which in a first embodiment a voltage waveform was applied to prevent charge accumulation on an insulating film on a substrate. The bias current ratio and the bias voltage ratio were independently varied. In a third embodiment a periodically reversed DC voltage was applied also to the target. The corresponding Figure 4 to this embodiment showed a waveform similar to the one of the first embodiment. It had to be considered that all the embodiments of this document were concerned with sputtering. The skilled person would have combined them to achieve an adequate reactive sputtering method. Moreover the patent and OIID5/OID6 addressed the same problematic, namely to avoid or minimize arcing due to charge up of insulating films, in the case of OID5/OID6 this was the substrate and in the case of the contested patent it was the insulating islands on the target.

- Charging up of insulating regions of the target was also addressed in OIID5 in the context of a planar magnetron reactive sputtering process. The proposed solution involved voltage reversal and it was pointed out that the applied waveform was not necessarily sinusoidal, but could have other shape and be asymmetrical. The skilled person could thus

select the desired waveform according to his necessities.

- Document OIID1 suggested the application of a mixed-mode sputtering in which AC and DC voltages were combined for avoiding arcing in reactive sputtering. The skilled person would have recognized that the voltage waveform of OID5/OID6 was a further development of the mixed-mode voltage waveform of OIID1 and would therefore have used a periodically reversed DC waveform for reactive sputtering in an obvious manner. In particular, as OIID1 suggested that further optimization of the sputtering process was required.

- Also document OIID8 suggested the replacement of an AC waveform by a periodically reversed DC voltage to increase sputtering rate. The skilled person would have hence combined the teachings of documents OIID1 and OIID8 and would have arrived at the waveform claimed in the contested patent without requiring an inventive step.

IX. Respondent opponent III argued essentially as follows:

- Reference was made to the opposition brief in relation to the objections of unallowable amendments and lack of novelty.

- The reactive sputtering system and method did not involve an inventive step having regard to the disclosure of document OID5/OID6 and the general technical knowledge of the skilled person, in this case a physicist or engineer working in the field of

coating systems. Document OID5/OID6 disclosed in the second embodiment the application of a periodically reversed DC voltage on the target having the parameters specified in the claims of the contested patent. This teaching was furthermore in agreement with claims 1 to 4 of this document. Hence the only features not disclosed in OID5/OID6 were the presence of a reactive gas and the use of a conductive material target. The objective technical problem addressed by the invention was therefore to find an alternative deposition method to the magnetron sputtering method disclosed in OID5/OID6, which avoided arcing without extinguishing the plasma. Reactive sputtering was however a sputtering method well known by the skilled person at the priority date of the patent. The skilled person would have replaced the insulating target by a conductive material target and provided a reaction gas in the sputtering chamber disclosed in document OID5/OID6 to obtain the deposition of the desired insulating film on the substrate without requiring an inventive step.

- Document OIID1 disclosed a mixed-mode reactive sputtering in which AC and DC voltages were combined. The skilled person, aware that the voltage waveform applied in document OID5/OID6 on the substrate avoided arcing at the substrate, would have applied this waveform to the target in the system disclosed in OIID1 and would have arrived at the claimed method in an obvious manner.

- The request of apportionment of costs was justified, since is was a procedural abuse that the appellant

proprietor submitted a new main and auxiliary requests in appeal after having not defended and withdrawn his auxiliary request during the opposition proceedings. If the amended request would have been submitted during the opposition proceedings then an appeal would have not been necessary.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 Claims 1 and 3 were amended with respect to the granted versions of these claims as highlighted under point III. The board considers that the use of a conductive material target, a DC voltage provided by a DC source and periodically reversing the plasma creating voltage are features that were disclosed in the original application in relation to the sputtering method and system (PCT publication, page 3, line 10; page 6, 1st paragraph; paragraph bridging pages 4 and 5). System claim 3 was further amended by incorporating original system claims 39, 41 and 42.

2.2 Respondent opponent III referred in relation to the objections of added subject-matter and novelty to his submissions during the opposition proceedings (reply of 18 March 2009, point I.1). Although no arguments were presented in appeal by respondent opponent III why the findings of the opposition division were incorrect, the board has reconsidered the reasons given by the

opposition division in the decision under appeal and agrees with their conclusion that in the present context the expressions "extinguishing said plasma" and "quenching said plasma" are to be considered synonyms.

2.3 The description was amended to render it consistent with the amended claims.

2.4 The respondent opponents did not raise other objections to the amendments of the claims or the description.

2.5 The board finds for these reasons that the amended patent meets the requirements of Article 123 EPC.

3. *Novelty*

3.1 As mentioned under point 2.2 only respondent opponent III alleged lack of novelty referring to his submissions during the opposition proceedings.

3.2 The board however agrees with the opposition division that the supply of a reactive gas, as claimed, has to be construed as an active method step not involving undesired leakages or gas residues. Such an active method step is however not disclosed in document OID5/OID6 and the sputtering method disclosed in this document cannot be regarded as a reactive sputtering method.

3.3 Also none of the other documents on file discloses a reactive sputtering method or system in which a periodically reversed DC voltage with the specific time periods as claimed is applied to the target.

3.4 The board therefore finds that the subject-matter of the claims is new (Article 54 EPC 1973).

4. *Inventive step*

4.1 The main issue in this appeal is that of inventive step.

4.2 The contested patent discloses a reactive sputtering method and system in which arcing is suppressed or avoided. In reactive sputtering a conductive material target is used for depositing an insulating film on the substrate. To convert the conductive material from the target into the desired insulator a reactive gas is provided in the sputtering chamber. The gas reacts with the material of the target to form the insulating compound on the substrate. At least some gas reacts directly with the target forming insulating islands on it, since not all of the target's exposed surface is being sputtered at the same rate. The insulating regions charge up with positive ions from the plasma and the sputtering rate is reduced or stopped (OIID1, page 392, left column, last two paragraphs).

4.3 If the charge accumulated at the insulating regions on the target exceeds a certain value electrical discharges or arcs may occur. The technical problem addressed by the patent is to minimize or avoid the occurrence of arcing, since this may damage the film deposited on the substrate and/or the power supply. This problem is solved by periodically clearing uneven build-up of charges by reversing the voltage applied to the target and thereby eliminating the source of the arc (patent specification, paragraphs [0003], [0005]).

4.4 The opposition division and the respondent opponents started in their assessment of inventive step from the assumption that document OID5/OID6 represented the closest prior art. The board is not persuaded that this document is a reasonable starting point for an assessment of inventive step, since it is undisputed that it does not relate to reactive sputtering, but as stated in its title to a bias sputtering method and apparatus. The board does not consider it reasonable to state the technical problem as to adapt the system and apparatus of OID5/OID6 to perform reactive sputtering. The skilled person trying to improve a reactive sputtering method and system would instead start from a conventional reactive sputtering apparatus. The skilled person does not start from a known voltage waveform and searches for a deposition method in which it may be used, but instead starts from a conventional deposition method and searches for a voltage waveform that solves specific issues arising in connection with the deposition method.

4.5 Hence the board considers that selecting document OID5/OID6 as starting point for the problem-solution approach is a choice tainted by hindsight. A realistic and correct assessment of inventive step based on the problem solution approach should start from a document relating to reactive sputtering.

4.6 The respondent opponents also argued that the method of claim 1 lacked an inventive step over a combination of documents OIID1 or OIID5 with OID5/OID6 or OIID8.

4.7 *Document OIID1*

4.7.1 Document OIID1 relates to the problems arising in a number of commercially important sputtering processes due to build-up of insulating layers on the target. These include reactive processes for the deposition of SiO_2, Al_2O_3, TiO_2, Ta_2O_3, TiN, TaN and ZrO_2 (Abstract).

4.7.2 OIID1 suggests that a "mixed-mode" sputtering (ie combining AC and DC signals) might be suitable to help to solve problems involved in the creation of insulating layers by reactive sputtering. In reactive sputtering it is nearly impossible to avoid the formation of unsputtered insulating regions on the target. Mixed-mode sputtering offers the potential of ameliorating the problem and permitting wider process latitude (page 392, left column).

4.7.3 Experiments were carried out in which a DC power supply and an AC power supply were combined. The AC power supply provided a pure sinusoidal AC power in the frequency range from 100-500 KHz and was employed at a frequency of 400 KHz. The reason for choosing this frequency was, according to OIID1, that the period of the signal be short compared with the ion transit time (page 392, right column).

There is thus a clear indication in this document not to apply low frequency voltages to the target.

4.7.4 The respondent opponents pointed out that document OIID1 suggested to continue searching for further improvements of the disclosed method, since it mentioned that although the achieved deposition rates

of SIO_2 were quite low, rates an order of magnitude higher could be expected in an optimized system (page 394, left column, 2nd paragraph). When a DC voltage was applied alone, one could visibly see material being ejected from the surface of the target while numerous defects in the film were present. In mixed-mode sputtering, on the other hand, little arcing was seen and the resulting films were nearly defect free. It was suggested that arcing could be further reduced by optimization of the system and process (page 394, left column, 3rd paragraph).

4.7.5 The sputtering method of claim 1 differs from the method disclosed in document OIID1 by the features of its characterizing portion, namely by periodically reversing a plasma creating DC voltage applied to the target for a time period between 1 and 10 microseconds without extinguishing said plasma, said reversing being effected from every 10 microseconds to every 2000 microseconds by applying a reverse voltage at a level of between 5 and 20 percent of said DC voltage (the claimed method thus requires a voltage reversal at a maximum rate of about 10 microseconds, ie a voltage reversal frequency of about 100 KHz).

4.7.6 Hence the technical problem addressed by the contested patent can be considered, as suggested by the respondent opponents, to be the optimization of the reactive sputtering process disclosed in document OIID1.

4.8 *Document OIID5*

4.8.1 Document OIID5 discloses a magnetron sputtering device for reactive sputtering. In such a device an AC voltage

is applied to the target so that during the negative part of the cycle sputtering takes place and during the positive part the exposed surface of the insulating regions can be discharged. Thus the cause of arcing can be effectively eliminated (column 2, lines 32-37; column 3, lines 3-4; column 4, lines 20-34). OIID5 further discloses that it is not necessary that the applied potential be sinusoidal or has a symmetrical waveform. For arc reduction, it is only necessary that the polarity reversal allows the surface of the insulating layer to be adequately discharged before the potential difference which would cause an arc is reached (column 4, lines 35-40).

4.8.2 This document hence also suggests the possibility of using different waveforms without, however, disclosing any specific waveform other than the used sinusoidal AC voltage (column 5, lines 25-26). Thus in the following document OIID1 will be used as starting point for assessing inventive step.

4.9 *Document OIID1 combined with OIID8*

4.9.1 Document OIID8 concerns conventional RF sputtering systems in which an RF sinusoidal voltage is applied to the target. It suggests replacing the sinusoidal waveform (Fig. 1) by a RF square-wave voltage (Fig. 2) in order to increase the sputtering rate (page 2172, last paragraph). Such a waveform allows easy control of the pulse repetition rate and the duty cycle of the applied voltage (page 2173, 2nd paragraph).

4.9.2 The RF sinusoidal voltage waveform shown in Fig. 1 corresponds to the mixed-mode waveform proposed in

document OIID1, since it is not a symmetrical waveform but is displaced to negative voltages by a value indicated as $V_{AVERAGE}$ in Figure 1. The voltage waveform shown in Figure 1 thus corresponds to the mixed-mode waveform disclosed by document OIID8 in which AC and DC signals are superimposed.

4.9.3 The board however is of the view that the skilled person would not be led to consider the frequency range claimed in the contested patent, since document OIID8 refers to RF sputtering whereas document OIID1 is concerned with reactive sputtering. The standard RF sputtering frequency is of about 13.56 MHz, much higher than the frequency range of about 100-500 KHz disclosed in document OIID1.

4.9.4 The board finds for these reasons that a combination of documents OIID1 and OIID8 does not lead to a periodically reversed DC voltage waveform in the 100 KHz frequency range as claimed in method claim 1.

4.10 *Document OIID1 combined with OID5/OID6*

4.10.1 As mentioned under point 4.4 document OID5/OID6 relates to bias sputtering in which a bias voltage is applied to the substrate to reduce the shadowing effect and improving step coverage for substrates having contact holes with an aspect ratio close to one.

4.10.2 It discloses in a first embodiment the deposition of a conductive Al layer on the substrate from a conducting Al material target. A periodically reversed DC voltage is applied to the substrate, ie the bias voltage, while a DC voltage is applied to the target (Figure 1). Two

measurement series were carried out in which either the bias voltage ratio, ie the relation between the magnitude of the positive and the negative voltages applied to the substrate, or the bias current ratio, ie the time during which each voltage was applied to the substrate, were varied.

4.10.3 In a second embodiment an insulator material target was used, which created *inter alia* charge-up of the target. A conventional sinusoidal RF voltage was applied to the insulator material target to perform sputtering (OID5, page 10, lines 15-17, Fig. 7). The positive voltage reduces the charge on the target, but also heats it up. Hence to reduce the heat on the target and the consequent peeling off from the indium backing film, the voltage level of the positive voltage was kept lower than the negative voltage (this shifting of the waveform to negative values corresponds to the "mixed-mode" voltages of document OIID1 or to the voltage waveform shown in Figure 1 of OIID8). Specific values for the voltage or the current ratio are not disclosed in this embodiment. It is moreover ambiguous whether the voltage applied to the target had a square or a sinusoidal waveform. It is mentioned in this connection that "the positive and negative voltages are alternately applied with the positive voltage being lower than the negative voltage" (OID5, sentence bridging pages 10 and 11). This statement appears to be equally applicable to a "mixed-mode" waveform and a periodically reversed DC waveform.

4.10.4 Finally, in a third embodiment the voltage waveforms shown in figures 3 and 4 were applied to substrate and target. The voltages shown in the upper and lower parts

of figures 1, 3 and 4 of OID5/OID6 representing, respectively, the voltages applied to the substrate and the target. However, again no specific values for the voltage ratio or the current ratio are given for this embodiment.

4.10.5 The appellant proprietor argued that OID5/OID6 disclosed in its third embodiment the use of an alternating RF voltage either with a sinusoidal or rectangular waveform.

Although the shapes of the bias and sputtering voltages shown in Figure 4 of OID5/OID6 are very similar, it is the established practice of the boards that specific values cannot be derived from a drawing of a patent document absent a clear disclosure supporting it. Document OID5/OID6 moreover discloses "to apply a conventional high frequency waveform to the target" (page 11, lines 15-16). It remains thus uncertain in OID5/OID6 whether the voltage applied to the target is a high frequency periodically reversed DC voltage (ie in the 10 MHz frequency range) or a voltage according to the first embodiment (ie with a frequency of about 100 KHz).

4.10.6 The teaching of document OID5/OID6 relates essentially to effects achieved at the substrate. In particular, the "Effects of the Invention" section on page 11 discloses three advantageous effects achieved at the substrate (effects 1, 2 and 4), while the sole advantageous effect achieved at the target (effect 3, ie preventing the target from peeling off the backing sheet) is an effect not related to a DC waveform but to shifting the waveform to negative voltages.

4.10.7 The board finds for these reasons that the skilled person would not be induced by a combination of documents OIID1 and OID5/OID6 to apply at the target a periodically reversed DC voltage in the 100 KHz frequency range.

4.11 The board finds for these reasons that the reactive sputtering method of claim 1 involves an inventive step within the meaning of Article 56 EPC 1973.

4.12 Claim 3 is directed to a reactive plasma sputtering system which essentially implements the method of claim 1. Hence the board finds that it involves an inventive step for the same reasons.

5. *Apportionment of costs (Article 104(1) EPC 1973)*

5.1 The respondent opponents requested apportionment of costs. Only the respondent opponent III substantiated this request arguing that the appellant proprietor withdrew his auxiliary request during the oral proceedings before the opposition division. Thus submitting an amended main request and new auxiliary requests in appeal amounted to an abuse of procedure.

5.2 The board however considers that it would not be equitable under the present circumstances to depart from the general principle that each party shall bear its own costs and order a different apportionment of costs. Filing amended main and auxiliary requests in appeal cannot be considered an abuse of procedure for the sole reason of filing them. This is the normal course of action of a loosing party.

5.3 The order for repartition of costs is a measure for restoring the balance between the normally occurring costs of a party and those extra costs incurred by an inappropriate behaviour of the other party. The board cannot recognize any extra costs incurred by the respondent opponents which go beyond the normal costs that have to be borne by any party to the appeal.

5.4 The board refuses for these reasons the requests for apportionment of costs of the respondent opponents.

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 in the following version:

   - description: pages 2 to 8 filed at the oral proceedings of 8 March 2013;

   - claims: 1 to 11 labelled main request, filed with the grounds of appeal;

   - drawings figs. 1 to 3 of the patent specification.

3. The request for apportionment of costs is refused.

Registrar	Chair
S. Sánchez Chiquero	G. Eliasson