Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 26 November 2013

Case Number: T 0099/10 - 3.3.05

Application Number: 97914622.2

Publication Number: 913502

IPC: C25D5/56, C23C18/40

Language of the proceedings: EN

Title of invention:
METHOD OF ELECTROPLATING NONCONDUCTIVE PLASTIC MOLDED PRODUCT

Patent Proprietor:
OKUNO CHEMICAL INDUSTRIES CO., LTD.

Opponent:
Atotech Deutschland GmbH

Headword:

Relevant legal provisions:
EPC Art. 56
RPBA Art. 12(4)

Keyword:
Inventive step (no)
- alleged effects: burden of proof (shifted to the patentee)
- reformulation of the problem (yes) - technical solution (obvious)

Decisions cited:
T 1797/09, T 0730/07

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 0099/10 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 26 November 2013

Appellant: (Opponent)	Atotech Deutschland GmbH Erasmusstrasse 20 10553 Berlin (DE)
Representative:	Beckmann, Claus Kraus & Weisert Patent- und Rechtsanwälte Thomas-Wimmer-Ring 15 80539 München (DE)
Respondent: (Patent Proprietor)	OKUNO CHEMICAL INDUSTRIES CO., LTD. 7-10, Dosho-machi 4 chome, Chuo-ku Osaka-shi Osaka 541 (JP)
Representative:	Meissner, Bolte & Partner Anwaltssozietät GbR Widenmayerstrasse 47 80538 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 10 December 2009 concerning maintenance of the European Patent No. 913502 in amended form.**

Composition of the Board:

Chairman: G. Raths
Members: A. Haderlein
P. Guntz

Summary of Facts and Submissions

I. This decision concerns the appeal of the opponent (appellant) against the interlocutory decision of the opposition division that the European patent No. 913 502 as amended according to the auxiliary request met the requirements of the EPC. The patent in suit concerns a method of electroplating a nonconductive plastic molded product.

II. In the notice of opposition reference was made *inter alia* to the following documents:

D2: WO-A1-96/29452
D9a: Experimental Test Report
annexed to the notice of opposition dated 28 February 2007, "Ermittlung der Haftfestigskeitwerte", 3 pages.

III. During the proceedings before the first instance, the following document was submitted by the patentee (respondent):

D9b: Experimental Report
annexed to the letter dated 14 January 2008, 5 pages.

IV. The opposition division had found that the main request filed under cover of the letter of the patent proprietor of 14 January 2008 did not comply with the requirement of Art. 123(2) EPC, but that the auxiliary request, filed at the oral proceedings before the opposition division, complied with the requirements of the EPC, in particular with Art. 123(2) and (3) EPC and with the requirements of novelty and inventive step.

V. The appellant's notice of appeal and its statement of grounds of appeal were received on 15 January 2010 and on 14 April 2010, respectively. The appellant requested that the decision under appeal be set aside and that the patent be revoked. In the statement of grounds of appeal reference was made to the following documents:

D10: Experimental Report dated March 30, 2010, 3 pages
D11: ASM Handbook (Extract).

In the notice of appeal, the appellant requested oral proceedings as an auxiliary measure.

VI. The reply by the patent proprietor (respondent) was received on 22 October 2010. It requested that the appeal be dismissed and on an auxiliary basis that oral proceedings be held. The respondent submitted the following document:

D12: Experimental Report by the respondent, 9 pages.

VII. The decision was announced at the oral proceedings held before the Board on 26 November 2013. At the oral proceedings the appellant requested that D12 should not be admitted into the proceedings.

VIII. Independent claim 4 of the auxiliary request which the opposition division found to comply with the EPC and on which the present decision is based reads as follows:

"4. An electroless copper plating solution which is an aqueous solution comprising 0.1 to 5 g/l, calculated as copper metal, of a copper compound, 2 to 50 g/l of a complexing agent, 3 to 50 g/l of a saccharide, and 10 to 80 g/l of an alkali metal hydroxide,

- the saccharide being at least one of grape sugar, glucose, sorbitol, cellulose, cane sugar, mannitol and gluconolactone; and
- the complexing agent being at least one of hydantoin compounds and organic carboxylic acids, said organic carboxylic acid being selected from at least one of citric acid, tartaric acid and succinic acid."

IX. The arguments by the appellant are summarised as follows:

a) D12 should not be admitted into the proceedings pursuant to Art. 12(4) RPBA as it related to an effect not previously discussed. Moreover, it could have been filed during the first instance proceedings.

b) Not all compounds in claim 4 which are said to be saccharides are true saccharides. In particular, as sorbitol, mannitol and gluconolactone do not have an aldehyde or ketone group, these could not be considered as saccharides, let alone as saccharides having a reducing property. In view of the structural difference between these compounds and saccharides such as glucose which is also claimed, the properties, and in particular the capacity to reduce copper, of these compounds cannot be said to be comparable. Consequently, if an effect was shown for one compound it could not be concluded that this effect would also be obtained by the remaining compounds.

c) The results of D12 were contradictory and therefore should not be considered. If any, D12 showed that the addition of a reducing agent to an

electroless copper plating solution without such an agent increases the amount of copper reduced and thus deposited onto the surface to be plated. This was however well known in the art. The reduction of the resistance of the copper layer was a direct consequence of the latter effect.

d) Apart from the above effect of the addition of a reducing agent, none of the effects mentioned in the patent in suit was actually obtained or improved over the closest prior art which was D2. In particular, considering the experimental evidence 9a and D10, the addition of mannitol to the solution known from D2 did not increase the adhesion of the copper layer. This was also not plausible as adhesion was primarily governed by the immersion reaction, i.e. reduction of copper by tin on the surface of the molded article, leading to a first layer of copper. The subsequent reduction of copper by the reducing agent such as glucose was much slower and, therefore, did not significantly, influence adhesion but rather only influenced the thickness of the copper layer obtained.

e) Starting from D2, the skilled person, in particular in the light of D11, when faced with the problem of increasing the amount of copper plated onto the molded article, would add glucose as a reducing agent. This was all the more obvious since D11 taught that there were health and environmental concerns regarding formaldehyde.

X. The arguments by the respondent are summarised as follows:

a) D12 was filed in response to the statement of grounds of appeal and D10 filed by the appellant. It was timely filed, i.e. within the time limit set for replying to the statement of grounds of appeal. The objection by the appellant concerning the admissibility of D12 was raised only at the oral proceedings before the Board. This objection was thus raised very late and could have been raised much earlier. For these reasons, D12 should be admitted into the proceedings.

b) D2 constituted the closest prior art for the subject-matter of claim 4. The distinguishing feature was the presence of a reducing agent, i.e. a saccharide selected from the compounds recited in claim 4. The problem to be solved was mentioned in paragraph [0008] of the patent in suit, i.e. "to provide a method of electroplating non-conductive plastic moldings by a simple procedure, the method being capable of forming a coating excellent in appearance and properties". The patent in suit disclosed a number of properties which were improved or at least as good as in the prior art such as the effluent treatability of the solution. Moreover, D12 showed another surprising effect, i.e. an increased amount of deposited copper leading to improved conductivity of the coating. This was due to the presence of mannitol which caused copper to deposit on the surface of the material to be plated even after it has been covered by copper due to the replacement reaction between tin adhered to the surface and the copper in the treatment solution.

c) D11 mentioned glucose but mainly taught to use formaldehyde as a reducing agent. Thus, when combining the teachings of D2 and D11, one would arrive at a solution comprising formaldehyde as a reducing agent and having the drawbacks discussed in the patent in suit. Also, there was no indication in D11 to use a weak complexing agent together with a weak reducing agent in order to achieve the effects described in the patent.

d) D10 was incomplete since the exact adhesion values were not disclosed and it only contained the allegation that there was no improvement when considering the accuracy of the measurement. Moreover, the appearance data for D2 were obtained in D10 by visual inspection which did not allow for an objective assessment of this property.

XI. Requests

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

The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. Admissibility of D12 - Article 12(4) RPBA

2.1 The appellant requested that D12 be not admitted into the proceedings because it could have been filed in the first instance proceedings and because it related to an effect not previously discussed.

2.2 According to established case law of the Boards of Appeal, filing a new document is considered in due time if the filing was occasioned by an argument or a point raised by another party and could not have been filed before under the circumstances of the case (see e.g. T 730/07 of 15 April 2010, reasons 1.1).

2.3 The filing of D12 is a reaction to the allegation by the appellant that the addition of a saccharide to the electroless copper plating solution known from D2 has no relevant effect (see page 6, 2nd full paragraph of the statement of grounds of appeal) and that neither the patent in suit nor D9b contained a comparison of solutions containing a saccharide and solutions not containing a saccharide. In fact, in D12 an attempt is made to show an effect caused by the addition of mannitol which is said to be a saccharide having a reducing property (see point 3.4 of the reply to the appeal), i.e. the distinguishing feature in view of the closest prior art D2.

It is true that the effect of increased amounts of copper deposition and resulting increase in conductivity was previously not referred to by the respondent. The Board considers it nevertheless legitimate to rely upon such an effect in view of the allegations of the appellant that the addition of a saccharide having a reducing property does not lead to any relevant effect at all.

2.4 Document D12 was presented by the respondent in its reply to the statement of grounds of appeal. This reply was timely filed, i.e. within the time limit set by the Board.

2.5 For the above reasons, the filing of document D12 was admissible and the document is therefore admitted into the proceedings by the Board.

3. Inventive step

3.1 The invention concerns a method of electroplating nonconductive plastic moldings and an electroless copper plating solution suitable for use in said electroplating method.

3.2 Such an electroless copper plating solution was known from D2 which the parties took as the starting point for assessing inventive step of the subject-matter of claim 4; in particular, the electroless copper plating solution used in step 5 of example 1 of D2 represents the closest prior art.

The electroless copper plating solution used in step 5 of example 1 (see page 15, lines 10-20) is an aqueous solution and comprises 4 g/l copper sulfate, i.e. an amount falling within the claimed range of 0.1 to 5 g/l of a copper compound calculated as copper metal, 15 g/l tartaric acid, and 25 g/l LiOH and 20 g/l NaOH. This was uncontested by the parties.

The Board can agree with this starting point.

3.3 According to the patent in suit the problem to be solved (see paragraphs [0001], [0008], and [0010]) consisted in providing an electroless copper plating solution suitable for use in a method of electroplating non-conductive plastic moldings by a simple procedure, the method being capable of forming a coating

excellent in appearance and properties,

and in addition, according to the respondent, the problem was to provide an electroless copper plating solution suitable for use in a method of electroplating non-conductive plastic moldings allowing for the deposition of

higher amounts of copper and, as a result, improved conductivity.

As regards the properties, several properties of the electroless solution according to the invention and of the resulting coating are referred to in the patent in suit (see paragraph [0063]) and in the experimental report D12. The properties referred to in the patent are:

- (a) deposition capability of electroplating in terms of time needed to cover a substrate (paragraphs [0064] and [0065]),
- (b) appearance after electroplating (paragraphs [0066] and [0067]),
- (c) adhesion (paragraphs [0068] and [0069]),
- (d) solution stability (paragraphs [0070] and [0071]),
- (e) solution controllability (paragraphs [0072] and [0037]), and
- (f) effluent treatability (paragraphs [0074] to [0076]).

The properties (a), (d), and (e) have not been invoked specifically by the respondent. For the sake of completeness, these are nevertheless dealt with by the Board (see *infra* at 3.5.1, 3.5.4, 3.5.5).

3.4 As a solution to said problem, the patent in suit proposes an electroless copper plating solution according to claim 4 of the auxiliary request (on which the appealed decision was based), characterised by 3 to 50 g/l of at least one of grape sugar, glucose, sorbitol, cellulose, cane sugar, mannitol and gluconolactone.

3.5 As to the success of the solution, it needs to be determined whether the above problem has been solved.

The Board deals with the properties one by one.

3.5.1 Deposition capability of electroplating in terms of time needed to cover a substrate

It is clear from paragraph [0065] of the patent in suit that it took longer to cover a substrate using the solution of the invention in comparison with the comparative examples of the patent in suit which however do not illustrate the closest prior art. The time needed for the invention examples was longer i.e. worse than that of the comparative examples. Since this property was not improved in the patent in suit and since no comparison with respect to the closest prior art is available, this property cannot be considered as having been improved.

3.5.2 Appearance after electroplating

In the patent in suit, this property is said to be improved (see paragraphs [0066] and [0067]).

According to D10 (page 3, table) filed by the opponent, when using the solution according to D2 neither flaws, nor pits nor star dust were observed and the coating

was esthetically pleasing as determined by visual inspection.

The argument by the respondent that such a visual inspection was not objective must fail as also in the patent in suit (see paragraph [0066]) this property was determined by visual inspection. Moreover, in the patent in suit it is said that the inferior appearance ("star dust") is obtained by the use of a reducing agent having a high reducing power such as paraformaldehyde (see paragraph [0003]). Since in D2 no reducing agent is used, it is not plausible that the appearance in D2 is inferior to the one obtained when using a solution according to claim 4 containing a reducing agent. Therefore, it is not credible that this property has been improved over the closest prior art.

3.5.3 Adhesion

In the patent in suit, this property is said to be improved (see paragraphs [0068] and [0069]).

The examples in the patent in suit (baths 1 to 8 and comparative baths 1 to 3) compare, on the one hand, solutions containing saccharides as defined in claim 4 and not containing formaldehyde and, on the other hand, solutions not containing those saccharides but containing formaldehyde. What is more, in the examples of the patent in suit different complexing agents are used what has a bearing on the availability of copper in the electroless plating solution. Thus, no direct conclusion can be drawn from these examples with regard to the addition of a saccharide (i.e. a reducing agent) such as glucose to a solution not containing a reducing agent.

According to the experimental report D9a submitted by the appellant during the first instance proceedings, when using a solution according to D2, adherence values of between 1170 and 1260 g are obtained (see last line on page 2 and the table on page 3 of D9a), i.e. a range which is within the range of the adhesion values obtained in the patent in suit, i.e. 1150 to 1280 g (see paragraph [0069]).

Although according to D9a the addition of glucose to the solution of D2 has not been tested, D9a shows that at least for some embodiments of the solution of claim 4, the adhesion has not been improved vis-à-vis D2.

Moreover, in D10 (report of the opponent) the influence of the addition of mannitol to the solution of D2 was tested and the report concludes that "adhesion for both kind of samples... is the same when considering the accuracy of the measurement".

The respondent contested the probative value of this report for two reasons:
(a) the adhesion values for each sample are not given and
(b) there is no indiction of the variation of the measured values that was referred to by the expression "the accuracy of the measurement" (see last paragraph on page 2 of D10).

In this respect the Board holds the view that D10 must not be judged as an isolated piece of evidence but rather must be assessed in the context of the case at hand.

In particular, the values measured in D9a vary from 1170 to 1260 g for the same solution (see the table on

page 3 of D9). In the absence of any evidence proving the contrary, it is therefore plausible that the values obtained in D10 also vary within this order of magnitude and thus do not allow to conclude that the adhesion was improved by adding mannitol.

Finally, it is also not plausible that the addition of a reducing agent to the solution of D2 has a significant influence on the adhesion of the copper coating finally obtained.

Both parties agreed that in D2 copper is deposited due to the replacement reaction between tin adhered to the surface of the material to be plated and copper in the treatment solution. Once the material to be plated is covered with copper, the replacement reaction does not further proceed. In the presence of a reducing agent such as glucose, copper is deposited even after the surface is already covered with copper.

According to the appellant, the reaction wherein tin is replaced with copper is much faster than the reduction of copper by glucose. Thus, the layer in contact with the nonconductive material is formed primarily by the first reaction (copper replacing tin), whereas the additional copper (due to reduction by the reducing agent such as glucose) is only deposited there-upon. This has not been contested by the respondent.

The Board therefore concludes that it is not plausible that the addition of a reducing agent such as glucose significantly influences the adhesion of the coating directly in contact with the surface to be plated, i.e. the coating generated by the exchange of tin by copper.

In view of the above, the Board arrives at the conclusion that it is not credible that the adhesion of the coating obtained in D2 has been improved by the addition of a reducing agent such as glucose.

3.5.4 Solution stability

This property is said to be improved according to the patent in suit (see paragraph [0071]).

Firstly, this property is not clearly defined. It appears from paragraph [0071] that the point in time of the inducement of decomposition was determined. But the patent in suit is silent about what exactly is meant by decomposition.

Moreover, it is not credible that the solution according to D2 which only contains a complexing agent (tartaric acid) and no reducing agent would be less stable than a solution actually containing a reducing agent, i.e. one in which metal copper tends to precipitate. In this context the Board also observes that the experiments conducted by the respondent in D9b show that even solutions containing a substantial amount of glucose can decompose immediately (see Comparative Bath I and the section "Solution stability" on page 3 of D9b).

The Board thus concludes that this property has not been improved.

3.5.5 Solution controllability

This property is said to be improved according to the patent in suit (see paragraph [0072]).

In particular, it is stated that "a coating was formed by electroplating from the baths of the invention under a wider range of each item of conditions than the comparative bath". However, no experimental data are given which would make it possible to determine the meaning of the relative term "wider range". Moreover, there are no comparative examples that would allow a conclusion on the controllability of the solution of D2.

In view of the above, the Board concludes that it is not credible that this property has been improved.

3.5.6 Effluent treatability

According to the patent in suit (see paragraph [0075]), this property has not been improved since the comparative examples show concentrations of remaining metals at least as low as the lowest concentrations obtained in the examples according to the invention. This was also confirmed by the respondent at the oral proceedings. Also, the comparative tests shown in D9b do not support that the addition of glucose to the solution of D2 would improve effluent treatability. The resulting metal concentrations of solutions according to the invention and tested in D9b are not lower than those obtained for comparative solutions in the patent in suit (*loc. cit.*).

It follows that this property has not been improved with regard to D2.

3.5.7 Increased amount of copper deposited

It is readily apparent that the addition of a reducing agent such as glucose to the solution of the closest

prior art D2 results in increased amounts of copper deposited onto the surface to be plated.

Improved conductivity is a direct consequence of the increased amounts of copper deposited onto the surface. The appellant did not contest that the problem of increasing the amount of copper deposited is successfully solved if the reducing agent is glucose. However, the appellant contended that the effect of increased amounts of deposited copper is achieved for all reducing agents recited in claim 4.

3.5.8 Burden of proof

As discussed during the oral proceedings before the Board, the burden of proof regarding the alleged success of the solution of the technical problem has to be determined.

(a) The respondent argued that the patent in suit described several improvements over the prior art. In opposition proceedings the opponent would bear the burden of proof to show that the claimed invention did not involve an inventive step. As the appellant had not discharged this burden, an inventive step should be recognised.

(b) The Board agrees with the respondent insofar as the technical problem set out in a patent is considered to be credibly solved by a claimed invention if there are no reasons to assume the contrary. In such circumstances, it is normally the opponent's burden to prove that the problem was not successfully solved or at least provide evidence casting doubts on the alleged success of the solution. However, if the opponent succeeds to

cast reasonable doubts on the alleged success of the solution, the burden to prove its allegations is shifted to the patent proprietor (see T 1797/09 of 8 February 2012, reasons 2.7).

(c) Therefore the question is whether the appellant succeeded at least in casting reasonable doubts on the solution of the technical problem.

(d) The reasoning under points 3.5.1 to 3.5.6 shows that there are reasonable doubts about the effects mentioned in the patent itself. Therefore, the burden of proof shifts to the respondent.

(e) As stated above (points 3.5.1 to 3.5.6), the submissions of the respondent, and in particular documents D9b and D12, are insufficient to remove the doubts on the alleged improvements mentioned in the patent.

3.5.9 Conclusion as to the success of the solution

The only effect actually obtained is the higher amount of copper deposited when using a reducing agent such as glucose and, as a result, increased conductivity of the coating.

However, claim 4 is directed to further compounds acting as a reducing agent, namely grape sugar, sorbitol, cellulose, cane sugar, mannitol and gluconolactone.

Although there is no evidence that would show that all the aforementioned compounds would lead to an increased deposition of copper, it is assumed for the sake of the following considerations, in favour of the respondent,

that the problem to obtain higher amounts of copper deposited is nonetheless solved over the whole scope of claim 4.

3.6 The problem is reformulated as to provide an electroless plating solution allowing to increase the amount of copper deposited onto the surface to be plated.

3.7 It remains to be decided whether the proposed solution is obvious in view of the cited prior art.

D11, which represents common general knowledge, discloses formaldehyde and sugars such as sucrose and glucose as reducing agents (see page 311, middle column second full paragraph). It also teaches that electroless plating solutions comprising tartrate as a complexing agent typically have 10 g/l reducing agent such as formaldehyde (see Table 1, column "Low build (tartrate)" on page 312).

According to the respondent, the skilled person when faced with the problem to be solved would use formaldehyde because D11 taught that formaldehyde is preferred. The reasons for this choice would be costs, effectiveness, and ease of control (page 311, middle column, 2nd full paragraph). The Board fails to follow this argument as D11 equally proposes glucose as a reducing agent and teaches that there are regulatory constraints for the use of formaldehyde because of its suspected carcinogenicity (*loc. cit.* and page 321, right-hand column, section "Handling"). Thus, there is a clear hint in D11 to use glucose as a reducing agent in electroless plating solutions.

Also, according to the respondent, it was not obvious to combine a weak complexing agent such as those listed in claim 4 with a weak reducing agent such as glucose in order to achieve the effects described in the patent.

This argument must fail as the process of D2 already uses a weak complexing agent, namely tartaric acid. Thus, the solution does not reside in the selection of a weak complexing agent and a weak reducing agent, but rather in the addition of a weak reducing agent such as glucose to the electroless plating solution of the closest prior art.

It is uncontended that the addition of a reducing agent in electroless copper plating leads to an increased copper deposition. In view of the teaching of D11, the Board concludes that faced with the problem to increase copper deposition in the process of D2, the skilled person would use glucose in a concentration falling within the claimed range of 3 to 50 g/l and thus would arrive in an obvious way at the subject-matter of claim 4.

3.8 It follows from the above that the subject-matter of claim 4 does not fulfill the requirements of inventive step set forth in Article 56 EPC.

Order

For these reasons it is decided that:

The decision under appeal is set aside.

The patent is revoked.

The Registrar: The Chairman:

C. Vodz G. Raths

Decision electronically authenticated