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Datasheet for the decision of 8 October 2013

Case Number: T 0492/11 - 3.3.09

Application Number: 01302373.4

Publication Number: 1134073

IPC: B32B27/32, C23C16/40

Language of the proceedings: EN

Title of invention:
Gas barrier film

Patent Proprietor:
DAI NIPPON PRINTING CO., LTD.

Opponent:
Schott AG

Headword:

Relevant legal provisions:
EPC Art. 54, 56, 100(c)

Keyword:
Amendments - added subject-matter (no)
Novelty - (yes)
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 0492/11 - 3.3.09

D E C I S I O N
of Technical Board of Appeal 3.3.09
of 8 October 2013

Appellant: (Patent Proprietor)	DAI NIPPON PRINTING CO., LTD. 1-1, Ichigaya-Kagacho 1-Chome, Shinjuku-Ku Tokyo 162-8001 (JP)
Representative:	Smart, Peter John Beck Greener Fulwood House 12 Fulwood Place London WC1V 6HR (GB)
Respondent: (Opponent)	Schott AG Hattenbergstrasse 10 55122 Mainz (DE)
Representative:	Herden, Andreas F. Blumbach - Zinngrebe PatentConsult Patentanwälte Alexandrastrasse 5 65187 Wiesbaden (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 30 December 2010 revoking European patent No. 1134073 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman: K. Garnett
Members: N. Perakis
W. Ehrenreich

Summary of Facts and Submissions

I. Mention of the grant of European patent No. 1 134 073 in the name of Dai Nippon Printing Co Ltd, was published on 4 January 2006 (Bulletin 2006/01). The patent was granted with 14 claims, claim 1 reading as follows:

"1. A gas barrier film comprising a base material and a vapour deposition film formed on both sides or one side of the base material, wherein a distance between grains formed on the surface of said vapour deposition film is from 5 to 40 nm."

Independent claim 10 related to a production method of a gas barrier film.

II. An opposition was filed by Schott AG and the patent was subsequently revoked by a decision of the opposition division issued in writing on 30 December 2010.

The revocation decision was based on claims 1 to 10 as filed with the proprietor's letter dated 12 November 2010. The opposition division considered that the subject-matter of the independent method claim 10 relating to a production method of a gas barrier film lacked an inventive step.

In an *obiter dictum* the opposition division considered that the subject-matter of claim 1 was novel and inventive over the filed documents.

Claim 1 read as follows:

"1. A gas barrier film comprising a base material and a silicon oxide vapour deposition film formed on both

sides or one side of the base material, wherein: the silicon oxide film is formed by the plasma CVD method and contains from 170 to 200 oxygen atoms and 30 or less carbon atoms per 100 silicon atoms, and further has an IR absorption peak based on the stretching vibration of Si-O-Si between 1055 and 1065 cm-1;
the distance between grains formed on the surface of said silicon oxide vapour deposition film is from 5 to 40 nm;
the thickness of the silicon oxide vapour deposition film is from 5 nm to 30 nm; and
the silicon oxide film has a refractive index of 1.45 to 1.48".

The filed documents included the following:

D1: A. G. Erlat et al, "SiOx Gas Barrier Coatings on Polymer Substrates: Morphology and Gas Transport Considerations", *J. Phys. Chem. B*, 1999, 103, pp 6047-6055;

D6: S.C. Deshmukh et al, "Investigation of SiO2 plasma enhanced chemical vapor deposition through tetraethoxysilane using attenuated total reflection Fourier transform infrared spectroscopy", *J. Vac. Sci. Technol. A*, Vol.13, No 5, Sep/Oct 1995, pp 2355-2367; and

D9: A. G. Erlat et al, "Morphology and gas barrier properties of thin SiOx coatings on polycarbonate: Correlations with plasma-enhanced chemical vapor deposition conditions", *J. Mater. Res.*, Vol 15, No. 3, Mar 2000, pp 704-717.
[D9, though late-filed, had been admitted into the proceedings by the opposition division]

III. On 25 February 2011 the patent proprietor (hereinafter: the appellant) filed an appeal against the decision of the opposition division and paid the appeal fee on the same day. The statement setting out the grounds of appeal was filed on 28 April 2011. It was accompanied by a main and two auxiliary requests. The claims of the main request were identical to the claims of the appealed decision. The claims of the first auxiliary request corresponded to those of the main request from which the claim relating to a production method of a gas barrier film, considered to lack inventiveness in the appealed decision, was deleted.

IV. By letter dated 21 November 2011, the opponent (hereinafter: the respondent) filed observations on the appeal.

V. Further arguments were filed by the appellant by a letter dated 15 August 2012.

VI. By a communication dated 30 July 2013 the board expressed a non-binding preliminary opinion on novelty and inventive step and raised a further objection under Article 100(c) EPC regarding the subject matter of claim 1.

VII. By letter dated the 20 September 2013, the appellant filed a third auxiliary request.

Oral proceedings were held before the board on 8 October 2013. During the oral proceedings the appellant withdrew its main request and did no longer pursue the second and third auxiliary requests. Consequently, the claims of the first auxiliary request constituted its sole request.

In support of its argument concerning the objection under Article 100(c) EPC, the appellant filed a translation of the priority document No.2000-302729. The respondent did not object to the admission of this document into the proceedings.

VIII. The relevant arguments put forward by the appellant in its written submissions and during the oral proceedings may be summarised as follows:

- The subject-matter of claim 1 found support in the application as filed taking into consideration the examples and the priority document filed during the oral proceedings.

- The subject-matter of claim 1 was novel over the disclosure of D1, which did not disclose the features concerning the number of carbon atoms per 100 silicon atoms in the silicon film, the IR absorption peak based on the stretching vibration of Si-O-Si in the silicon film and the refractive index of the silicon film.

- The subject-matter of claim 1 involved an inventive step since D1, the closest state of the art, did not give the skilled person aiming at an optimised gas barrier film any hint as to how to reduce the thickness of the film while maintaining excellent gas barrier properties. Such information could not been found in the other cited prior art documents.

IX. The relevant arguments put forward by the respondent in its written submissions and during the oral proceedings may be summarised as follows:

- The subject-matter of claim 1 lacked novelty over D1. The alleged differentiating features were not explicitly disclosed in D1 but they were implicitly derivable from it. Thus, regarding the number of carbon atoms, it had to be optimised following the disclosure of D1; regarding the IR absorption peak, it was an inherent property of the film of D1 in view of the disclosure of D6 (page 2358, lines 14-15); regarding the refractive index of the film of D1, it was also an inherent property of the film of D1 in view of the disclosure of D9 (Figure 3b).

- The subject-matter of claim 1 lacked inventive step starting from D1 as closest prior art and taking into consideration D9.

X. The appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the first auxiliary request filed with the statement of the grounds of appeal.

XI. The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. Amendments under Article 100(c) EPC

2.1 The subject-matter of claim 1 seems at first sight to relate to a combination of various, independent aspects of a gas barrier film disclosed in the originally filed

application. Each of these aspects define the gas barrier film using different features. So the first aspect (page 3, line 4) defines the film on the basis of the number of oxygen, carbon and silicon atoms and the peak position of IR absorption band based on the stretching vibration of Si-O-Si; the second aspect (page 4, line 1) on the basis of the distance between grains formed on the surface of the vapour deposition film; the third aspect (page 4, line 16) on the basis of the E' centre of the silicon oxide film; the fourth aspect (page 5, line 8) on the basis of the IR absorption peak of the stretching vibration of the CO molecules.

2.2 The board accepts the explanation of the appellant, which was not contested by the respondent, that the skilled person would clearly and unambiguously derive the subject-matter of claim 1 from the originally filed application considering on the one hand the general disclosure of the invention, page 30, lines 9-13:

"A gas barrier film in the present invention may use a vapor deposition layer having two or more properties in common from among properties of vapor deposition layers shown in the above-mentioned first to fourth embodiments",

and on the other hand the disclosure in the experimental part of the original application, page 59, lines 13-14:

"Examples 2-1 to 2-3 were obtained in like manner as defined in Examples 1-1 to 1-3",

according to which the films of examples 1-3 and 2-3 are not different films but one and the same film; the

particularity of each of these examples is that it concerns the measurement of different parameters of the very same product.

Thus, on the one hand the general disclosure allows the combination of various disclosed aspects in the same silicon film and on the other hand the technical part of the patent illustrates that this was indeed performed in examples 1-3 and 2-3.

On the basis of the above considerations the board acknowledges that the subject-matter of claim 1 satisfies the requirements of Article 100(c) EPC.

3. Novelty

3.1 The respondent contested the novelty of the gas barrier film of claim 1 on the basis of the disclosure of D1. However, the board does not consider that D1 discloses all the features of the claimed film.

3.2 It is not contested that D1 discloses a gas barrier film manufactured following plasma-enhanced chemical vapour deposition (PECVD) on at least one side of a substrate (page 6047, abstract). Furthermore, D1 discloses that the distance between grains on the surface of the silicon oxide vapour deposition film measures 24 ± 4 nm and thus falls within the claimed range (page 6050, right column, lines 3-7 from the bottom). D1 also discloses that the thickness of the deposited film typically ranges from about 20 to 200 nm and therefore overlaps with the claimed thickness range (page 6048, right column, lines 13-15).

3.3 However, D1 does not disclose the number of oxygen and carbon atoms per 100 silicon atoms. D1 merely discloses

that by optimising the deposition power and the monomer and oxygen flow rates the level of impurities incorporated within the film, such as CO and CO_2, is minimised (page 6049, left column, lines 1-5 and left column lines 5-15 from the bottom). This general statement does not provide, at least implicitly, any concrete number of the oxygen or carbon atoms per 100 silicon atoms, contrary to the argument of the respondent.

Furthermore, D1 is silent regarding the refractive index, which the board considers not to be an inherent feature of the film disclosed in D1. The argument of the respondent, that this feature was inherently present in the film of D1 in view of the disclosure of D9 (page 706, figure 3(b)) is not accepted. D9 does not disclose that a refractive index of 1.45 to 1.48 corresponds to the lower film thickness disclosed by D1, namely 20 to 30 nm. On the contrary, D9 discloses that at such a low thickness value the refractory index is necessarily lower than 1.45. In this context it is to be noted that the appellant explained both in the written phase and during the oral proceedings that the patent in suit achieves the claimed high refractive index by the control of the conditions of the plasma CVD deposition method, in particular of the closing electric power level, the pressure during film forming and the flow rates of both oxygen and the organic silicon compound (page 17, table 1). These conditions are different from those applied in the method of D1 (page 6049, left column, table 1).

3.4 Regarding the IR absorption peak of the stretching vibration of Si-O-Si, this is also not explicitly disclosed in D1. Furthermore, the board does not consider that this feature is clearly and unambiguously

derivable from the disclosure of D1. Incidentally, what this document discloses is, that HMDSO (hexamethyldisiloxane) with a Si-O-Si group in its structure is used for the manufacture of the gas barrier film (page 6048, top of right column "Scheme 1" and lines 16-22; page 6050, right column, line 9 from the bottom). The value of the IR absorption peak of the stretching vibration of the Si-O-Si group is no doubt known from D6 (page 2358, right column, lines 14-16) but it concerns the HMDSO used for the making of the silicon film. The appellant explained, without being contradicted by the respondent, that this is not necessarily the value of the Si-O-Si in the silicon film since the exact value would depend on the structural environment of this group in the gas barrier film; thus it could not be concluded that the absorption peak would be at 1055 cm-1.

3.5 In view of the above considerations the gas barrier film of claim 1 is novel over D1.

4. Inventive step

4.1 Closest prior art

The patent in suit aims at providing a gas barrier film having an excellent gas barrier property while maintaining the flexibility required by the film applications (paragraphs [0007] and [0041]).

D1 (page 6047, abstract) discloses gas barrier films with a SiO_x coating on polymer substrates, the coating being made by plasma-enhanced chemical vapour deposition (CVD) of SiO_x film on polymer surfaces. This is considered by the board to represent the closest state of the art. Both parties agreed on this point.

4.2 The technical problem

The problem underlying the patent in suit in the light of D1 is to optimise the gas barrier film so that it combines flexibility and excellent gas barrier properties.

As a solution to this problem the patent in suit proposes a gas barrier film according to claim 1.

The technical evidence in the patent (page 17, table 1) and the additional technical evidence to be found in the translation of the priority document filed during the oral proceedings (page 22, table 1) illustrate that the gas barrier film of examples 1-3 and 2-3, the only examples according to the claimed invention, shows excellent barrier properties against oxygen gas and water vapour since the value of the oxygen gas transmission rate is 0.08 $cc/cm^2/day.atm$ and of the water vapour transmission rate is 0.28 $g/m^2/day$, values which are much lower than the upper limit set by the patent in suit (paragraph [0019]).

4.3 Obviousness

The skilled person starting from D1 and aiming at the provision of an optimised gas barrier film would find in D1 a hint to use a thin silicon oxide film since D1 discloses a thickness of 20 nm. However, he would not find in this document any hint towards a thin silicon oxide film which on the one hand guarantees the required flexibility of the gas barrier film and on the other hand provides the film with the necessary gas barrier qualities on the basis of the claimed combination of elemental constitution, IR absorption peak based on the stretching vibration of Si-O-Si,

grain distance and refractive index of the silicon oxide film.

What D1 discloses is that silicon oxide can be manufactured using vapour deposition conditions which lead to the complete oxidation of elements such as carbon and hydrogen and that unwanted by-product gases (e.g., CO, CO_2 and H_2O) are subsequently vented out of the plasma chamber, thereby minimizing the level of impurities incorporated within the SiO_x coating (page 6049, left column, lines 5 to 11 from the bottom). Thus D1 does not give the skilled person any explicit or implicit indication of the claimed restriction regarding the amount of carbon atoms which can be allowed in the silicon oxide film.

Furthermore, the skilled person does not find in D1 any hint towards the claimed refractive index of the silicon oxide film. Even if he consulted D9 (page 706, table 3(b)), he would discover that the refractive index of 1.45 to 1.48 would only be possible for silicon oxide films having a thickness above 60 nm. Thus, he would conclude that a thin film such as that of D1 would necessarily have a lower refractive index than the one claimed. This means that the combination of D1 with D9 leads to subject-matter different from that claimed.

Consequently, the skilled person would not find in the state of the art any instruction which would lead him to the claimed gas barrier film.

4.4 On the basis of the above considerations the board comes to the conclusion that the subject-matter of claim 1 is not obvious and consequently involves an inventive step.

5. The subject-matter of dependent claims 2 to 5, which is concerned with particular embodiments of the gas barrier film of claim 1, is *mutatis mutandis* novel and inventive.

6. Claims 6 to 9 relate to products incorporating the gas barrier film of claims 1-5. These products are also novel and inventive for the reasons given for claim 1.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent on the basis of the first auxiliary request filed with the statement of the grounds of appeal after any necessary consequential adaptation of the description.

The Registrar: The Chairman:

M. Canueto Carbajo K. Garnett

Decision electronically authenticated