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**D E C I S I O N**  
**of 5 September 2005**

**Case Number:** T 0694/99 - 3.3.9

**Application Number:** 90904481.0

**Publication Number:** 0420950

**IPC:** B32B 7/02

**Language of the proceedings:** EN

**Title of invention:**  
Coated Glass Articles

**Patentee:**  
Libbey-Owens-Ford Co.

**Opponent:**  
Saint-Gobain Vitrage

**Headword:**

-

**Relevant legal provisions:**  
EPC Art. 56, 83

**Keyword:**  
"Inventive step (yes)"  
"Sufficiency of disclosure (yes)"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 0694/99 - 3.3.9

**D E C I S I O N**  
**of the Technical Board of Appeal 3.3.9**  
**of 5 September 2005**

**Appellant:** Libbey-Owens-Ford Co.  
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**Representative:** Halliwell, Anthony Charles, et al.  
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**Respondent (s):** Saint-Gobain Vitrage  
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**Representative:** Renous Chan, Véronique  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office orally announced on  
13 April 1999 and posted 29 April 1999 revoking  
European patent No. 0420950 pursuant to  
Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** P. Kitzmantel  
**Members:** W. Ehrenreich  
B. Günzel

## Summary of Facts and Submissions

- I. Mention of the grant of European patent No. 0 420 950 in respect of European patent application No. 90 904 481.0 in the name of *LIBBEY-OWENS-FORD CO.*, filed on 16 February 1990 as international application PCT/US 90/00897, was announced on 3 April 1996 (Bulletin 1996/14).

The patent, entitled "*Coated Glass Articles*", was granted with twenty two claims, independent Claims 1 and 7 reading as follows:

"1. A coated glass article (35), comprising: a glass substrate (36), a coating of titanium nitride (38) and a coating of silicon complex (39), deposited on and adhering to the coating of titanium nitride, characterized in that the coating of titanium nitride (38) is deposited on and adheres to the surface of the glass substrate (36); the coating of a silicon complex (39) is represented by the general formula  $\text{SiC}_x\text{O}_y$  wherein x is more than 0 but not more than 1, and y is more than 0 but not more than 2, and in that there is further provided, optionally, a coating of a metal oxide or an oxide of silicon (40) deposited on and adhering to the coating of the silicon complex (39), said coated glass article (35) having a visible light transmittance less than 36%, a shading coefficient measured at both the coated and glass sides less than 0.5, a glass side visible reflectance less than 20%, and a coated side visible reflectance less than 25%."

"7. A process for preparing coated glass articles, comprising providing a glass substrate (36), having a surface, and depositing a coating on said surface, characterized in that the process comprises depositing onto the glass substrate (36) surface a coating of titanium nitride (38), by reacting a mixture of a titanium tetrahalide a and a reducing agent, at or near the surface of the glass substrate (36), depositing onto the titanium nitride coating (38) a coating of a silicon complex (39), represented by the general formula  $SiC_xO_y$  wherein x is more than 0 but not more than 1, and y is more than 0 but not more than 2, by reacting a gas mixture containing a silane, and optionally either or both of an olefin and an oxidizer, at or near the surface of the titanium nitride coating; and optionally, depositing onto the silicon complex coating a coating of an oxide of silicon or a metal oxide (40), said coated glass article having a visible light transmittance less than 36%, a shading coefficient measured at both the coated and glass sides less than about 0.5, a glass side visible reflectance less than 20%, and a coated side visible reflectance less than 25%."

Claims 2 to 6 were dependent on Claim 1 and Claims 8 to 21 were dependent on Claim 7. Claim 22 pertained to a glazing for automotive and architectural windows, comprising a coated glass article (35) as defined in Claim 1.

II. Notice of Opposition requesting revocation of the patent in its entirety on the grounds of Article 100(a) and 100(b) EPC was filed by *SAINTE GOBAIN VITRAGE* on 27 December 1996.

With regard to Article 100(a) EPC the opposition was - *inter alia* - based on the following documents:

- (A) WO-A 88/01568
- (B) EP-A 0 239 280
- (C) US-A 4 535 000
- (H) FR-A 2 382 511

Under Article 100(a) EPC the Opponent suggested that the claimed subject-matter lacked both novelty (Article 54 EPC) and inventive step (Article 56 EPC). However, only arguments as to lack of inventive step were provided.

With respect to the objection as to lack of an inventive step the Opponent considered document (A) to be representative of the closest prior art. (A) described a coated glass article from which the claimed coated glass article essentially differed in that the TiN (titanium nitride) coating was deposited directly onto the glass surface, whereas according to (A) a silicon based intermediate coating between the glass surface and the TiN coating was provided. The Opponent, *inter alia*, argued that it was obvious from either (B) or (C) to omit this intermediate silicon layer and to arrive at the claimed subject-matter without an inventive effort.

Under Article 100(b) EPC the Opponent argued that the claimed coated glass article had to meet a number of photometrical properties. However, the definition of the silicon coating  $\text{SiC}_x\text{O}_y$  in Claims 1 and 7 was unduly broad and embraced coatings consisting of virtually

pure silicon (Si), if x and y were close to zero, silicon carbide (SiC), if x was equal to 1 and y was close to zero, or quartz (SiO<sub>2</sub>), if x was close to zero and y was 2, such coatings having entirely different photometrical characteristics. There was nothing in the patent specification which would give an indication to a skilled person which ratio C/O in the silicon coating had to be chosen in order to achieve the required photometrical properties. Therefore, the skilled person could not carry out the invention, contrary to the requirements of Article 83 EPC.

III. During the oral proceedings before the Opposition Division the Patent Proprietor defended the subject-matter of the patent as granted and filed as an auxiliary request a set of Claims 1 to 22. Claims 1 and 7 of this request differ from the corresponding granted Claims in that the range for the visible light transmittance of the coated glass article had been changed from "less than 36%" to "15% to less than 36%". This amendment was attacked by the Opponent under Article 123(2) EPC.

IV. With its decision orally announced on 13 April 1999 and issued in writing on 29 April 1999 the Opposition Division revoked the patent.

The Division held that the Opponent's objection of lack of novelty under Article 100(a) EPC was not substantiated and that the objection under Articles 100(b) and 123(2) EPC was unfounded.

With respect to the question of inventive step it was held in the decision that the claimed coated glass

article differed from the glass article according to the closest prior art (A) by the omission of the first silicon layer between the glass surface and the TiN coating. This omission, however, was obvious in the light of document (B), disclosing coated glass sheets with a TiN layer directly bonded to the glass substrate. In this context the photometrical requirements given in Claims 1 of the main and auxiliary requests merely expressed desiderata suggested by considerations of usefulness relevant to conventional architectural glass applications. The claimed subject-matter, therefore, lacked an inventive step.

- V. On 3 July 1999 the Patent Proprietor (Appellant) lodged an appeal against the decision of the Opposition Division. The Statement of Grounds of Appeal was submitted on 9 September 1999 and was accompanied by a new main request and three auxiliary requests.

The main request corresponded to the first auxiliary request submitted during the oral proceedings in the opposition procedure. Claims 1 and 7 of this request read as follows:

"1. A coated glass article (35), comprising: a glass substrate (36), a coating of titanium nitride (38) and a coating of silicon complex (39), deposited on and adhering to the coating of titanium nitride,

characterized in that the coating of titanium nitride (38) is deposited on and adheres to the surface of the glass substrate (36);

the coating of a silicon complex (39) is represented by the general formula  $\text{SiC}_x\text{O}_y$  wherein x is more than 0 but not more than 1, and y is more than 0 but not more than

2, and in that there is further provided, optionally, a coating of a metal oxide or an oxide of silicon (40) deposited on and adhering to the coating of the silicon complex (39), said coated glass article (35) having a visible light transmittance of from 15% to less than 36%, a shading coefficient measured at both the coated and glass sides less than 0.5, a glass side visible reflectance less than 20%, and a coated side visible reflectance less than 25%."

"7. A process for preparing coated glass articles, comprising providing a glass substrate (36), having a surface, and depositing a coating on said surface, characterized in that the process comprises depositing onto the glass substrate (36) surface a coating of titanium nitride (38), by reacting a mixture of a titanium tetrahalide a and a reducing agent, at or near the surface of the glass substrate (36), depositing onto the titanium nitride coating (38) a coating of a silicon complex (39), represented by the general formula  $SiC_xO_y$  wherein x is more than 0 but not more than 1, and y is more than 0 but not more than 2, by reacting a gas mixture containing a silane, and optionally either or both of an olefin and an oxidizer, at or near the surface of the titanium nitride coating; and optionally, depositing onto the silicon complex coating a coating of an oxide of silicon or a metal oxide (40), said coated glass article having a visible light transmittance of from 15% to less than 36%, a shading coefficient measured at both the coated and glass sides less than about 0.5, a glass side visible reflectance less than 20%, and a coated side visible reflectance less than 25%."



VI. The Appellant's arguments as to the presence of an inventive step submitted in writing may be summarized as follows:

The invention differed from the closest prior art represented by document (A) in a number of important features: It was directed to a medium performance solar control product exhibiting:

- a light transmission of from 15 to 36%, a shading coefficient less than 0.5, exemplified by the values of 0.43, 0.37 and 0.48, respectively;
- a reduced light reflectance with visible reflectance values of less than 20% and 25% on the glass side and the coated side, respectively.

By contrast, document (A) showed a lower light transmission with values of less than 15% and a higher visible reflectance with values of about 30%, as exemplified by the examples 1 and 2. These optical properties were caused by the use of reflective silicon coatings of the formula  $\text{SiC}_x\text{O}_y$  with small values for  $x$  and  $y$ . This was evident from the examples 3 and 4 of (A), where the outer silicon coating was prepared by reacting ethylene with silane in a low ratio of 1 : 2, in conjunction with document (H), from which it was known, having regard to page 2, lines 36/37 and table I of (H), that low ethylene proportions led to a higher visible reflectance.

Therefore, the teaching of the patent, which in column 8, lines 28 to 32 of the specification proposed the use of a considerably higher ethylene to silane

ratio of 2.4 to 1, went in the opposite direction because this measure led to a silicon coating having a low reflectance.

In order to arrive at the invention, the skilled person starting from document (A) had to make a number of changes including:

- omission of the inner silane layer entirely;
- increase of the light transmission from less than 15% up to 15 to 36%;
- reduction of the reflectivity of the outer silicon layer to result in a coated-side visible reflectance of less than 25% via increase of the ethylene to silane content.

There was no indication in the prior art which would motivate the skilled person to omit the silicone intermediate layer of (A) between the glass surface and the TiN layer.

Although it was mentioned in document (B) that a TiN coating could be directly bonded to the glass surface, this prior art recommended the interposition of a SnO (tin oxide) coating between the glass and TiN in order to promote uniform nucleation and to insulate TiN from undesirable interaction with glass.

VII. In the appeal proceedings, the Respondent (Opponent) did not submit a reasoned statement. With letter dated 17 May 2000 the Respondent merely referred to its submissions provided in the opposition proceedings.

- VIII. The Appellant requested maintenance of the patent on the basis of the main request or alternatively of one of the three auxiliary requests, submitted with the Statement of Grounds of Appeal.
- IX. The Respondent maintained its request made in the opposition proceedings that the patent be revoked.
- X. On 2 November 2004 the Parties were summoned to attend the oral proceedings scheduled for 9 February 2005. The summons was followed by a communication of the Board dated 9 November 2004 with provisional comments with respect to the Respondent's objections provided in the opposition proceedings under the Articles 100(a), 100(b) and 123(2) EPC.

With the letter dated 6 January 2005 the Appellant withdrew the request for oral proceedings and informed the Board that it did not intend to attend the proceedings. In response to the Appellant's letter the Respondent communicated to the Board with letter dated 6 January 2005 that it, on its part, did not consider it useful to attend the oral proceedings, but that the request to revoke the patent for the reasons set out in the appealed decision was maintained.

- XI. The oral proceedings were cancelled. In a communication dated 4 February 2005 the Board expressed, in a detailed reasoned statement, its preliminary position that the subject-matter of Claims 1 and 7 of the main request was based on an inventive step. The Parties were given an opportunity to file observations within two months.

The Respondent requested an extension of the period by one month, but did not submit any observations within the extended period.

With the letter dated 13 June 2005 the Appellant filed an amended specification which had been adapted to conform to the main request.

### **Reasons for the Decision**

1. The Appeal is admissible.
2. A final decision can be taken because the Respondent did not avail itself of the opportunity to submit observations on the grounds on which the decision is based (communication of the Board of 4 February 2005, amended patent specification submitted with the Appellant's letter dated 13 June 2005).
3. *Article 123(2) EPC*

In the Board's judgment the introduction into Claims 1 and 7 of the main request of the lower limit of 15% for the visible light transmission complies with Article 123(2) EPC because this feature is fairly disclosed in the original application, for example on page 8, line 21.

4. *Novelty (Article 54 EPC)*

This ground of opposition had never been substantiated by the Respondent and need not be considered, therefore, in these proceedings.

5. *Inventive step (Article 56 EPC)*

5.1 The subject-matter of the patent in suit

The patent in suit according to Claim 1 of the main request concerns a coated glass article wherein a glass substrate is coated with a TiN coating which is directly deposited onto the surface of the glass substrate and wherein a  $\text{SiC}_x\text{O}_y$  complex coating (with  $x$  greater than 0 and equal to or less than 1 and  $y$  greater than 0 and equal to or less than 2) is adhered to the TiN coating. The glass substrate is further characterised by the following thermal and optical parameters:

- the visible light transmittance is from 15% to less than 36%;
- the shading coefficient at both the coated and glass sides is less than 0.5;
- the glass-side visible reflectance is less than 20% and
- the coated-side visible reflectance is less than 25%.

The presence of a metal oxide or silicon oxide coating on the  $\text{SiC}_x\text{O}_y$  coating is optional.

Claim 7 pertains to the process for preparing the above coated glass article.

In the patent specification it is stated in column 2, lines 20 to 29, that the glass article of the invention exhibits low emittance properties resulting in improved insulating capabilities over uncoated glass articles with otherwise identical compositions/thicknesses. Furthermore, the coated glass article is characterised by low visible reflection both from the glass and the coated surface, and a low shading coefficient.

According to example 1 to 5 of the patent specification, the claimed parameters are achieved by applying a  $\text{SiC}_x\text{O}_y$  coating onto the TiN layer via reaction of a silane (tetrahalosilane) with a gas mixture including ethylene.

## 5.2 The closest prior art

Document (A) is representative of the closest prior art. This document discloses a coated glass article with a first silicon coating adhered to the surface of the glass substrate, a TiN coating adhered to the first silicon coating and a second silicon coating adhered to the TiN coating.

A metal oxide coating adhered to the second silicon coating is optional (cf. Claim 1).

At page 13, lines 22 to 27, it is stated that the coated glass articles have a visible light

transmittance of less than 15% and a shading coefficient (glass side and coated side) of less than 0.35, preferably 0.23 to 0.32.

The glass article according to Claim 1 of the main request thus differs from the glass articles in (A) in that the silicon base layer has been omitted and the visible light transmittance is at least 15% and less than 36%, i.e. lies in a higher value range than that according to document (A).

### 5.3 Problem and solution

5.3.1 In view of the experimental evidence on file, the problem to be solved by the claimed invention is seen in providing a coated glass article with values of visible light transmittance, shading coefficient and visible reflectance as specified in Claim 1.

5.3.2 The solution to this problem is the manufacture of a glass article with only two coating layers, i.e. a TiN coating directly adhered to the glass surface and a silicon topcoating of the type  $\text{SiC}_x\text{O}_y$ , with indices "x" and "y" as defined in Claim 1. Examples 1 to 4 of the patent specification show that the claimed optical and thermal properties, including a visible light transmittance considerably above 15%, are effectively achieved by a two-layer coating with an ethylene-modified silicon topcoat.

### 5.4 Obviousness

5.4.1 In assessing inventive step, the question to be answered is whether the skilled person starting from

document (A) would be motivated by the prior art to omit the silicon base coating in order to obtain glass articles with the claimed properties including an elevated visible light transmittance.

- 5.4.2 In the Board's judgment, the prior art gives no incentive to a skilled person to do so.

From document (A) the skilled person draws the conclusion that the TiN layer has to be positioned between a silicon base layer and a silicon top layer in order to obtain coated glass articles with a visible light transmittance of less than 15% and a shading coefficient of less than 0.35. There is nothing in (A) that would motivate the skilled person to omit the silicon base layer in order to arrive at glass articles with properties as specified in Claim 1. Therefore, document (A) alone does not render the claimed subject-matter obvious.

The above conclusion is not changed by combining (A) with document (B), disclosing a coated glass article, wherein in one variant a TiN layer can be directly adhered to the glass surface and tin oxide is applied onto the TiN coating as a top layer (column 3, lines 5 to 10).

Firstly, there is no information in document (B) nor in the further available prior art on the basis of which the skilled person could assume that the contribution of the tin oxide topcoat used according to (B) to the solar light and heat transmission properties of TiN coated glass sheets could be equated with that of the silicon-containing topcoat used according to document



(A). Consequently, no reliable prediction is possible as to the effect on the said properties of the omission of the silicon-containing base coat between the glass sheet and the TiN coating, which, according to (A), is obligatory. Moreover, according to the patent in suit, column 5, lines 19 to 22, tin oxide may be used as a final coating for the completely different purpose of imparting durability to the glass article.

Secondly, document (B) itself strongly recommends, for several purposes, the interposition of a "protective oxide coating" between the glass sheet and the TiN solar shielding film (see column 3, lines 28 to 58).

The skilled person being aware of (B) would therefore not expect that the omission of the silicon base coating used according to document (A) would be advantageous in order to solve the problem posed.

The other documents of the prior art are further off than (A) and (B) and cannot contribute to the solution of the problem posed, whether alone or in combination with (A) and/or (B).

5.4.3 For the above reasons, the Board concludes that the subject-matter of Claim 1 is not obvious from the prior art and, therefore, involves an inventive step.

This conclusion is also valid for Claim 7 concerning a process for the preparation of the coated glass article according to Claim 1 and Claim 22 pertaining to a glazing comprising the coated glass article according to Claim 1.

6. *Sufficiency of disclosure (Article 83 EPC)*

In the Board's view, the invention can also be carried out by a person skilled in the art in the sense of Article 83 EPC because the presentation of the invention in the claims in conjunction with the description of the application as originally filed and the patent specification is such that the skilled person is able to realise the invention reliably.

With respect to the provision of the silicon layer of the formula  $\text{SiC}_x\text{O}_y$ , the Board refers to the original application, in particular page 10, line 22 to page 11, line 5, page 12, lines 17 to 20, the examples 1, 4 and 5 in conjunction with the Claims 38 and 39, as well as to the patent specification, column 7, lines 16 to 36, column 8, lines 28 to 32, the examples 1, 4 and 5 in conjunction with Claim 17. These passages are concerned with the oxidizing or non-oxidizing gas mixture as precursor composition of the silicon coating to be deposited onto the TiN layer.

With the information given in the above passages, and on the basis of his common general knowledge, the skilled person is able to prepare the silicon coating  $\text{SiC}_x\text{O}_y$  by reacting silane, olefin and oxidizer in a suitable molar ratio in order to achieve the photo-metrical properties of the coated glass article as required by Claims 1 and 7.

7. The amended specification (see point XI) satisfies the stipulations of Article 84 EPC.

8. For the reasons set out in points 3 to 7 the main request complies with the requirements of the EPC. In these circumstances, it is not necessary to deal with the auxiliary requests.

## 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 following documents, all filed with the letter of 13 June 2005:

description: columns 1 to 11,

Claims: 1 to 22,

figures 1 and 2.

The Registrar:

The Chairman:

G. Röhn

P. Kitzmantel