

**Internal distribution code:**

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

**Datasheet for the decision  
of 10 March 2011**

**Case Number:** T 0308/07 - 3.3.05

**Application Number:** 99966212.5

**Publication Number:** 1140721

**IPC:** C03C 17/36

**Language of the proceedings:** EN

**Title of invention:**

Methods and apparatus for producing silver based low emissivity coatings without the use of metal primer layers

**Patentee:**

PPG Industries Ohio, Inc.

**Opponents:**

Pilkington Deutschland AG  
SAINT-GOBAIN GLASS FRANCE  
INTERPANE Entwicklungs- und Beratungsgesellschaft

**Headword:**

Sputtered coatings/PPG

**Relevant legal provisions:**

EPC Art. 52(1), 56

**Keyword:**

"Inventive step (all requests): no - simplified process suggested by prior art"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 0308/07 - 3.3.05

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.05  
of 10 March 2011

**Appellant:**  
(Patent Proprietor) PPG Industries Ohio, Inc.  
3800 West 143rd Street  
Cleveland, OH 44111 (US)

**Representative:** Polypatent  
Postfach 40 02 43  
D-51410 Bergisch Gladbach (DE)

**Respondent 01:**  
(Opponent 01) Pilkington Deutschland AG  
Haydnstrasse 19  
D-45884 Gelsenkirchen (DE)

**Representative:** -

**Respondent 02:**  
(Opponent 02) SAINT-GOBAIN GLASS FRANCE  
18, avenue d'Alsace  
F-92400 Courbevoie (FR)

**Representative:** Jamet, Vincent  
Saint-Gobain Recherche  
39, quai Lucien Lefranc  
B.P. 135  
F-93303 Aubervilliers Cedex (FR)

**Respondent 03:**  
(Opponent 03) INTERPANE Entwicklungs- und  
Beratungsgesellschaft mbH & Co. KG  
Sohnreystrasse 21  
D-37698 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 21 December 2006 revoking European patent No. 1140721 pursuant to Article 102(1) EPC.**

**Composition of the Board:**

**Chairman:**            G. Raths  
**Members:**            B. Czech  
                          C. Vallet

## Summary of Facts and Submissions

- I. The appeal is against the decision of the opposition division to revoke European patent No. 1 140 721.
- II. In the contested decision, the opposition division found inter alia that the amended claims according to the requests then on file were either objectionable under Article 123(2) EPC (main request and auxiliary requests 1 and 2) or under Article 123(2) and (3) EPC (auxiliary requests 3 and 4), or that their subject-matter lacked an inventive step (auxiliary requests 5 and 6). The claims according to said auxiliary requests 5 and 6 were held to meet the requirements of Articles 123(2)(3), 84, 83 and 52(1)/54(1)(2) EPC. Claim 1 according to said auxiliary request 6 reads as follows:

*"1. A method of forming a transparent coated article, comprising the steps of:*

- (i) sputter depositing a first antireflective layer (84) onto a transparent substrate; and*
- (ii) sputter depositing a first infrared reflective silver layer (86) onto the first antireflective layer (84); and*
- (iii) sputtering a conductive ceramic cathode (40), wherein (ii) and (iii) is carried out in the same coating chamber of a coater in an inert atmosphere containing a low percentage of oxygen and controlling the oxygen content in said atmosphere being from greater than zero to 20 Vol.% of oxygen to deposit a first ceramic layer (88) of metal doped metal oxide onto the first infrared reflective silver layer (86)."*

The opposition division came to the conclusion that the method according to claim 1 of said auxiliary request 6 did not involve an inventive step in view of the combined teachings of documents

E8: DE 36 28 057 A1 and

E13: DE 28 30 723 A1.

- III. Under cover of its statement of grounds of appeal of 26 April 2007, the appellant (proprietor of the patent) filed eight sets of amended claims as new main request and auxiliary requests 1 to 7. It submitted that the claims as amended according to all requests met the requirements of Articles 83, 84 and 123(2) and (3) EPC, that the claimed subject-matter was novel over the disclosure of E8 and was not obvious in view of documents E8 and E13.
- IV. In their replies, respondents 1 and 3 (opponents 1 and 3) raised various objections against the appellant's requests under Articles 123(2) and (3), 84, 83 EPC and regarding novelty over E8. Moreover, they considered that the methods as claimed according to all said requests were not inventive in view of the combined teachings of documents E8 and E13.
- V. In a further written submission, the appellant rebutted the objections raised by the respondents and defended the requests on file.
- VI. The parties were summoned to oral proceedings. In a communication issued in preparation for the oral proceedings, the board commented on the technical

problem and additionally questioned novelty and inventive step with respect to the use claims comprised in the sets of claims on file.

VII. Respondent 2 (opponent) filed a written submission addressing the issues of clarity of the claims, of the allowability of the amendments under Articles 123(2) and (3) EPC, and of sufficiency of disclosure (Article 100(b) EPC).

VIII. Oral proceedings were held on 10 March 2011.

In the course of the oral proceedings, the appellant filed three amended sets of claims as new main and auxiliary requests 1 and 2, replacing the requests previously on file.

Independent claim 2 according to the new main request is identical (except for its numbering) to claim 1 of auxiliary request 6 refused by the opposition division (see point II above).

Independent claim 2 according to the new auxiliary request 1 only differs from claim 2 according to the new main request in that the oxygen content range "*from greater than zero to 20 Vol.%*" was replaced by "*from **3 Vol%** to 20 Vol.%*" (emphasis added).

Independent claim 1 according to the new auxiliary request 2 is identical (except for its numbering) to claim 2 according to auxiliary request 1.

The debate at the oral proceedings was focused on the issue of inventive step in view of documents E8 and

E13, more particularly having regard to the method with consecutive deposition of three layers according, i.e. claim 2 of the new main request, i.e. according to claim 2 of the new auxiliary request 1 and claim 1 of the new auxiliary request 2.

IX. The essential arguments of the parties concerning the issue of inventive step can be summarised as follows.

The appellant submitted that the claimed subject-matter was inventive in view of E8 and E13. It emphasised that E8 expressly taught that the silver layer had to be deposited in an oxygen-free atmosphere. As described in the example of E8, the deposition chamber was evacuated and then filled with pure argon before sputtering the silver layer. Hence, E8 did not disclose controlling the oxygen content to be more than zero to 20 Vol.-%. Taking E8 as the closest prior art, the technical problem to be solved consisted in providing a method which was both simpler and permitted maintaining the metal:oxide stoichiometry of the ceramic target in the ceramic layer deposited onto the silver layer, as addressed in section [0020] of the patent in suit. The claims according to the auxiliary requests filed at the oral proceedings took into account the information contained in section [0028] of the patent in suit, namely that substoichiometric layers may be obtained in an atmosphere containing less than 3% oxygen. At the oral proceedings the appellant conceded that the process according to E8 permitted maintaining the stoichiometry of the sputtered ceramic layer. However, E8 emphasised the necessity of depositing the silver layer in an oxygen-free atmosphere, whereby the process required relatively complex manipulations for changing

the atmosphere in the sputtering chamber. The appellant held that the skilled person would not have considered E13, let alone combined its teaching with that of E8. E13 was published about 20 years before the filing date of the patent in suit and none of the more recent documents took up the teaching of E13, which consisted in a process adopting a different approach for depositing the different layers. More particularly, in the process according to E13 the metal oxide layers were obtained by reactive sputtering of metallic targets and not of ceramic targets as in E8. In the reactive sputtering step, the oxygen was captured ("gettered") by the highly reactive target metal being oxidised, whereas this was not the case when a ceramic cathode was sputtered. Moreover, it was alleged that the deposited metal oxide would draw oxygen atoms from oxidised silver. The teaching of E13 having regard to the possibility of sputtering silver in an atmosphere containing oxygen was limited to a process wherein the preceding and subsequent deposition steps comprised reactive sputtering of metal targets. Unexpectedly, it had been shown that silver could be sputtered in the same oxygen-containing atmosphere that was used in the subsequent sputtering of the ceramic cathode. For these reasons, the skilled person starting from E8 could only arrive at the claimed subject-matter based on ex-post-facto considerations involving the contents of E13.

The respondents argued inter alia that even a process with all the features of claim 1 according to the new auxiliary request 2 filed at the oral proceedings did not involve an inventive step in view of the combined teachings of documents E8 and E13. E8 recommended an oxygen content of less than 10% in the step for



depositing the ceramic cathode onto the silver layer (page 4, line 10 ff.). Starting from E8 as the closest prior art, the technical problem could only consist in providing a simpler process, i.e. a process requiring no different atmospheres and no additional evacuation step before the sputtering of the silver layer. Neither the publication date of E13 nor the particularities of the process described therein would keep the skilled person from considering its contents. The skilled person could gather from E13 the technical information that a silver layer of the required quality could also be deposited in an atmosphere containing a relatively low amount of oxygen. Moreover, E13 expressly mentioned the advantages of a simplified process using a same atmosphere in a same coating chamber. E13 thus suggested modifying the process of E8 in a manner leading to the claimed subject-matter.

- X. The appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the claims according to the main request or, alternatively, according to auxiliary request 1 or 2, all said requests having been filed during the oral proceedings.

The respondents requested that the appeal be dismissed.

## **Reasons for the Decision**

- 1. Admissibility of the appellant's requests
  - 1.1 The three sets of claims filed as new requests at the oral proceedings comprise straightforward amendments in

response to an objection raised in the board's communication (all requests: deletion of "use" claims), amendments already proposed during the opposition proceedings and which could thus be expected (all requests: inter alia "silver" as the metal layer), and a narrowing amendment (auxiliary requests 1 and 2: "3 Vol%" as the new lower limit for the oxygen content range instead of "greater than zero"). The latter amendment can be considered as a reaction to the debate at the oral proceedings regarding the importance of the presence of a certain amount of oxygen during the sputtering of the metal doped metal oxide layer over the silver layer.

- 1.2 Considering all these aspects, the board decided to admit the appellant's three requests despite their late filing, pursuant to Article 13(1) and (3) RPBA.
  
2. In the light of the board's negative finding regarding the compliance of the claims according to the appellant's present requests with the requirement of Article 52(1) in conjunction with Article 56 EPC (inventive step), there is no need to further elaborate on other pending objections raised by the respondents in the course of the appeal proceedings.
  
3. Auxiliary request 1 - Inventive step - Claim 2
  
- 3.1 The invention relates to a method of forming a transparent coated article. The article is to be used as an architectural window, insulating unit or automotive glass or windshield, the articles being made by sputtering multi-layer coatings comprising an IR-reflective metal layer onto a transparent substrate

(see section [0001] and claims 1 to 4 and 18 to 21 of the patent as granted).

3.2 The board concurs with the parties that document E8 can be considered to represent the closest prior art.

3.2.1 E8 (see claim 1 and page 2, lines 27 and 28) also relates to a method for the fabrication of heat-reflective glass panes comprising a multi-layered coating including a noble metal layer. The coated glass panes are to be used as architectural or automobile windows. The method according to E8 comprises applying at least three superimposed layers onto the glass substrate by sputtering.

3.2.2 A specific example of such a method for producing a heat-reflective glass pane is described in detail on page 3, lines 35 to 68 of E8. The layered structure obtained is shown in Figure 2 of E8. The apparatus used for sputtering the different layers is schematically illustrated by Figure 1 of E8 and described on page 3, lines 21 to 34. The apparatus comprises a single coating chamber ("Vakuumbehälter 1") with two gas feed tubes 10 and 11 provided with valves 9a and 9b, respectively, and an outlet 3 connected to a vacuum pump. An inert gas such as argon may be fed to the chamber via tube 10, and a mixture of an inert gas and oxygen may be fed via tube 11. Two cathodes 5 and 6 consisting, respectively, of metallic silver and zinc oxide comprising 3 mole-% alumina (hereinafter "ZnO/Al<sub>2</sub>O<sub>3</sub>") are arranged within said coating chamber, and the glass pane 16 to be coated can be moved by a belt conveyor 12 such as to face either cathode 5 or cathode 6.

3.2.3 The example of E8 undisputedly discloses the sputtering of three layers onto the glass substrate in three distinct, consecutive steps:

- A first (antireflective) layer 17 of ZnO-Al<sub>2</sub>O<sub>3</sub> is sputtered under an atmosphere controlled to comprise 5% oxygen and 95% argon at a pressure of 0.4 Pa using cathode 6. After the deposition of layer 17, the feed of argon and of the oxygen/argon gas mix to the coating chamber 1 is interrupted by closing valves 9a and 9b, and the coating chamber 1 is evacuated to a higher vacuum of 10<sup>-3</sup> Pa.

- Thereafter, argon gas only is fed to chamber 1 via tube 10 and an IR-reflective metallic layer 18 of silver is sputtered onto the layer 17 at a pressure of 0.4 Pa using the silver cathode 5.

- Subsequently, a further (ceramic) layer 19 of (metal doped metal oxide) ZnO-Al<sub>2</sub>O<sub>3</sub> is deposited onto the silver layer 18 under the same conditions (page 3, line 65: "unter der gleichen Bedingung") as during the deposition of the first ZnO-Al<sub>2</sub>O<sub>3</sub> layer 17, i.e. by sputtering under an atmosphere with a low oxygen partial pressure using the (conductive ceramic) ZnO/Al<sub>2</sub>O<sub>3</sub> cathode 6.

3.3 According to the appellant, the technical problem underlying the patent in suit in the light of document E8 was to provide a more simple process while at the same time maintaining the stoichiometry of the ceramic material, i.e. avoiding an undesirable loss of oxygen leading to a deposited ceramic layer with a

substoichiometric metal:oxygen ratio (see page 5, lines 27 to 39 of the patent in suit).

- 3.4 As a solution to this problem the patent in suit proposes the method according to amended claim 2, which is characterised inter alia in that steps (ii) and (iii) of the claimed method are *"carried out in the same coating chamber of a coater in an inert atmosphere containing a low percentage of oxygen and controlling the oxygen content in said atmosphere being from 3 Vol% to 20 Vol.% of oxygen to deposit a first ceramic layer (88) of metal doped metal oxide onto the first infrared reflective silver layer (86)"*.

- 3.5 For the board, taking into account the technical information and experimental data (see e.g. sections [0025] and [0026] in conjunction with Figures 4 to 6; section [0027] in conjunction with Table 2) presented in the patent in suit, it is credible that coated IR-reflective glass having the required properties is obtainable by sputtering, within a same coating chamber, a silver layer and the ceramic layer of doped metal oxide in an atmosphere comprising between 3 and 20 Vol.% of oxygen.

Moreover, performing the deposition of the silver layer and of the ceramic layer in a same chamber in an atmosphere having the stated oxygen content requires no complex measures for exchanging the sputtering atmosphere before and after the silver layer deposition and/or for separating the atmospheres of different coating chambers.

The board is thus satisfied that the technical problem stated under point 3.3 above is successfully solved by the claimed method.

3.6 Hence it remains to be decided whether the claimed solution is obvious in the light of the prior art.

3.7 According to E8 (claim 1 and page 3, lines 7 to 13), the use of an oxygen-free atmosphere during the sputtering of the noble metal layer, e.g. silver, is mandatory in order to avoid the deleterious effects of oxygen without having to deposit a protective metal layer over the noble metal layer (E8: page 3, lines 1 to 3).

Therefore, this document taken alone cannot suggest a modification of the process described therein consisting in carrying out the noble metal layer deposition in an atmosphere with a controlled oxygen content of 3 to 20 Vol.%.

3.8 Document E13 also relates to a process for the fabrication of IR-reflective glass panes, i.e. for architectural windows, comprising the deposition by sputtering of a multilayer coating of dielectric metal oxides, such as zinc oxide, and noble metals, such as silver, onto the glass pane (E13: page 3, lines 1 to 8; page 7, lines 12 to 18; page 6, lines 15 to 17). According to example 2 of E13 (page 9), a glass substrate (for windows) is first coated with a layer of ZnO by reactive sputtering using a metallic zinc target in an atmosphere comprising 1% oxygen and 99% argon. Within the same coating chamber, the substrate is then moved to face a silver target and a layer of metallic

silver is sputtered on the ZnO layer without changing the sputtering atmosphere. A third layer of ZnO is finally deposited onto the silver layer in the same coating chamber, again without changing the sputtering atmosphere.

- 3.8.1 The process described in E13 involves sputtering multi-layer coatings onto glass for the same purpose as according to E8, i.e. in order to obtain IR-reflective window panes. Moreover, the technical problem underlying the invention according to E13 also consists in providing a process simplified in terms of the required apparatus and process features (E13: page 5, lines 9 to 14). Moreover, the author of E13 was aware of and expressly addressed problems previously associated with the deposition of silver layers (page 6, lines 17 to 20).

As pointed out by the appellant, E13 was published in 1980, i.e. about five years before the priority date of E8 (1985) and about 19 years before the priority date of the patent in suit (1999). However, the age of a document is not in itself a sufficient reason for excluding it from the prior art to be considered in the assessment of inventive step.

The board thus concludes that the skilled person starting out from E8 and confronted with the stated technical problem would definitely consider the contents of E13.

- 3.8.2 The fabrication process according to E13 differs from that of E8 in that the first and third layers made of ZnO are deposited by the reactive sputtering of a

metallic zinc target in an oxygen-containing atmosphere. However, in the board's view, these differences are not such as to bring the skilled person to disregard the entire technical information content of this document. On the contrary, the skilled person can gather from E13 (page 5, lines 15 to 21; page 6, line 10, to page 7, line 28) that products of the required quality may be obtained by sputtering first a layer of silver in an atmosphere comprising up to 10% oxygen, preferably 1 to 5 % oxygen, followed by the reactive sputtering of a metal oxide layer, e.g. ZnO, onto the silver layer, i.e. using a metal target in the same oxygen-containing atmosphere. By adjusting the sputter voltages (the sputter rate) and the relatively low oxygen content of the atmosphere to each other, oxidation of the silver layer can be avoided and metal oxide layers having the desired properties can be deposited by reactive sputtering. Accordingly, products are obtained which have optical properties (IR-reflectivity and visible light transmittance) comparable to those of products obtained when sputtering the silver layer in a pure inert gas atmosphere.

- 3.8.3 Moreover, E13 (page 5, lines 9 to 14; page 5, line 22, to page 6, line 9) expressly identifies the advantages over previously known techniques (E13: page 4, line 21, to page 5, line 8), in terms of process and apparatus features, achievable by using a same oxygen-containing sputtering atmosphere throughout the consecutive deposition steps. In particular, E13 mentions the possibility of depositing the different layers without having to change the sputtering atmosphere between different deposition steps, as well as the possibility of applying the different layers using different



targets arranged within a same coating chamber, rather than in several chambers separated in terms of the differing working atmospheres prevailing in them.

- 3.8.4 In view of the above, the board finds that the skilled person starting from the specific process disclosed in the example of E8 and looking for a solution to the stated technical problem, would be prompted by E13 to dispense with the relatively complex changes of the sputtering atmosphere within the deposition chamber before and after the silver deposition step, and to perform the sputtering of all three layers, including the silver layer, in a same chamber using a sputtering atmosphere as exemplified in E8, i.e. containing about 5 Vol.% oxygen. As acknowledged by the appellant, at such an oxygen concentration the ceramic layer deposited onto the silver layer does not suffer from a loss of oxygen.
- 3.8.5 In doing so, the skilled person would, on the one hand, expect in view of the teaching of E13 that the deposited silver layer would have the required properties. On the other hand, considering the teachings of E8 and E13, the skilled person would not, in the board's view, expect that the subsequent deposition of a ZnO-Al<sub>2</sub>O<sub>3</sub> layer in a low oxygen atmosphere of about 5 Vol.% could negatively affect the properties of the silver layer, even in the absence of an intermediate protective metal layer. In particular, the skilled person would have no reason to depart from the oxygen concentration of about 5 Vol.% disclosed in the example of E8 and would thus not expect or experience problems due to a partial reduction of the ceramic material sputtered onto the silver layer.

- 3.9 In proceeding as set out under point 3.8.4 above, the skilled person would thus arrive at a process falling within the ambit of claim 2 without an inventive step being involved (Articles 52(1) and 56 EPC).
4. The appellant's first auxiliary request is thus not allowable.
5. Auxiliary request 2 - Inventive step - Claim 1
- 5.1 Claim 1 according to the second auxiliary request is identical (but for its numbering) to claim 2 according to the first auxiliary request. Therefore, the above reasoning (points 3.1 to 3.8.5) concerning the obviousness of the method claimed applies also to claim 1 according to the second auxiliary request.
- 5.2 Since present claim 1 does not meet the inventive-step requirement of Article 52(1) EPC in conjunction with Article 56 EPC, the second auxiliary request is not allowable either.
6. Main request - Inventive step - Claim 2
- 6.1 Claim 2 according to the main request differs from claim 2 according to the first auxiliary request only in that the numerical range for the oxygen content of the atmosphere prevailing during steps (ii) and (iii) is broader in the former claim, i.e. "*from greater than zero to 20 Vol.%*", than in the latter claim ("*from 3 to 20 Vol.%*").
- 6.2 The subject-matter of present claim 2 thus includes the non-inventive subject-matter of claim 2 according the

first auxiliary request. Therefore, the subject-matter of present claim 2 cannot be considered to involve an inventive step over the full breadth of the claim.

6.3 Since present claim 2 does not meet the requirements of Article 52(1) EPC in conjunction with Article 56 EPC, the appellant's main request is not allowable either.

7. In summary, none of the appellant's requests is allowable.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar

The Chairman

C. Vodz

G. Raths