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Datasheet for the decision of 27 January 2010

Case Number: T 0102/07 - 3.3.05

Application Number: 99973009.6

Publication Number: 1140723

IPC: C03C 17/36

Language of the proceedings: EN

Title of invention:
Improvements in coating glass

Patentee:
Pilkington Group Limited

Opponent:
SAINT-GOBAIN GLASS FRANCE

Headword:
Heat-treatable glass/PILKINGTON

Relevant legal provisions:
EPC Art. 54(1)(2), 56

Keyword:
"Main request and first auxiliary request: Novelty (no); whole content approach; one choice among a list of two alternatives"
"Second and third auxiliary requests: Inventive step (no); problem not solved over the whole scope of the claim; reformulation of the problem; technical solution foreshadowed in one document"

Decisions cited:
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Catchword:
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Case Number: T 0102/07 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 27 January 2010

Appellant: (Opponent)
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 21 November 2006 concerning maintenance of European patent No. 1140723 in amended form.

Composition of the Board:

Chairman: G. Raths
Members: J.-M. Schwaller
S. Hoffmann

Summary of Facts and Submissions

I. The present appeals were lodged against the interlocutory decision of the opposition division maintaining the patent in amended form on the basis of the set of claims submitted during the oral proceedings of 26 September 2006 as a second auxiliary request and including independent claims 1, 18 and 19 reading as follows:

"*1. A process for the production of a heat-treatable low emissivity coated glass that comprises the steps of a) depositing an underlayer which comprises a silicon oxide onto a glass substrate and b) subsequently depositing a reflective metal layer by a vacuum deposition method, characterised in that the underlayer is deposited by a pyrolytic deposition process and the reflective metal layer is deposited directly on the underlayer.*

18. A coated glass produced by a process according to any one of the preceding claims.

19. A heat-treatable low emissivity coated glass comprising a glass substrate having a multilayer coating on one surface, said multilayer coating comprising a pyrolytically deposited underlayer comprising a silicon oxide, a vacuum deposited reflective metal layer deposited directly on to the underlayer and a vacuum deposited anti-reflection layer."

II. During the opposition proceedings, the parties relied *inter alia* upon the following documents:

D1: EP 0 745 569 A1

D2: EP 0 718 250 A1

III. In the contested decision, the opposition division considered the subject-matter of the above claims to involve an inventive step, because it solved the problem of protecting the metallic reflective layer from oxygen degradation by using a smaller number of layers than in D2. The opposition division also found that there was no suggestion in D2 to deposit the reflective layer directly on to the SiO_2 underlayer.

IV. Appeals were lodged by both the patentee (hereinafter "appellant I") and the opponent (hereinafter "appellant II").

V. With its grounds of appeal filed by letter of 20 March 2007, appellant I submitted three sets of claims as the main, first and second auxiliary requests, respectively.

Independent claim 20 of the main request reads:

"*20. A heat-treatable low emissivity coated glass comprising a glass substrate having a multilayer coating on one surface, said multilayer coating comprising a pyrolytically deposited underlayer, a vacuum deposited reflective metal layer deposited directly on to the underlayer and a vacuum deposited anti-reflection layer*."

Independent claim 18 of the first auxiliary request reads (differences from the main request emphasised by the board):

*"18. A heat-treatable low emissivity coated glass comprising a glass substrate having a multilayer coating on one surface, said multilayer coating comprising a**n** underlayer **which has been deposited by a chemical vapour deposition process**, a vacuum deposited reflective metal layer deposited directly on to the underlayer and a vacuum deposited anti-reflection layer"*.

Independent claim 16 of the second auxiliary request reads (differences from the first auxiliary request emphasised by the board):

"*16. A heat-treatable low emissivity coated glass comprising a glass substrate having a multilayer coating on one surface, said multilayer coating comprising an underlayer **comprising a silicon oxide or titanium oxide** which has been deposited **using** a chemical vapour deposition process, a vacuum deposited reflective metal layer deposited directly on to the underlayer and a vacuum deposited anti-reflection layer.*"

VI. In its grounds of appeal filed by letter of 1 April 2007, appellant II/opponent held claim 19 as maintained in the contested decision to lack an inventive step over the content of document D2 when taken alone or in combination with common general knowledge.

VII. In a letter of observations filed on 1 October 2007, appellant II/opponent further held the subject-matter of claim 20 of the main request to lack novelty over examples b) and c) of document D1.

VIII. Under cover of the letter dated 27 November 2009, appellant I/patentee filed a statement containing further experiments which appellant II/opponent requested should not be admitted into the proceedings, because it had been filed late.

IX. Further comments from the parties were received with the following letters:

- appellant I/patentee, a letter dated 8 January 2010;
- appellant II/opponent, a letter dated 12 January 2010.

X. Oral proceedings took place on 27 January 2010.

XI. Appellant I/patentee 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, first or second auxiliary request, all filed with the letter of 20 March 2007, or as a third auxiliary request that the patent be maintained on the basis of the claims allowed according to the interlocutory decision of the opposition division.

Appellant II/opponent requested that the decision under appeal be set aside and that the patent be revoked.

Reasons for the Decision

1. *Main request - Novelty*

1.1 Appellant II held the subject-matter of claim 20 of this request to lack novelty in the light of the disclosures at page 8, lines 11 to 28 - in particular the stacks b) and c) - and page 5, lines 4 to 14 of D1.

1.2 Appellant I argued that the stacks b) and c) disclosed at page 8, lines 11 to 28 of D1 were described as being "mathematical modelisations", without however any indication of the preparation method to be used for manufacturing said stacks.

Concerning the preparation method disclosed in the passage at page 5, lines 4 to 14 of D1, this related to the embodiments of the invention as disclosed in claim 1 of D1, not to those described as mathematical modelisations.

1.3 The board observes that D1 relates to transparent substrates, in particular made of glass, coated with a stack of thin layers including at least one metal layer having reflective properties against long-wavelength infrared radiation and/or solar radiation (page 2, lines 3 to 5).

In its claim 1, D1 defines the invention as being a coated transparent substrate comprising at least one layer having reflection properties in the infra-red or in the solar radiation range or both, interposed between a first and second coating comprising a dielectric material, an interlayer comprising a

material having a refractive index less than that of the substrate being interposed between the substrate and the stack such that the difference in refractive indices between the substrate and the interlayer is at least 0.07.

1.4 Although D1 always makes use in its examples of a ZnO layer under the silver layer, it discloses (page 8, lines 11 to 14) that the invention may be used likewise in stacks of the type dielectric/silver/dielectric **which do not make use of wetting layers of the ZnO or Nb_2O_5 type under the silver** (emphasis added), the low-index interlayer **according to the invention** (emphasis added) improving in all cases the colorimetry in reflection, whatever the intended "level of emissivity". D1 further discloses (page 4, lines 15 to 54) that mathematical modelisations made on the basis of the following three stacks a) b) and c):

a)	glass	/ SnO_2	/ Ag	/ NiCr	/ SnO_2
	3 mm	40 nm	10 nm	5 nm	42 nm
b)	glass	/ AlO_xF_y	/ Ag	/ NiCr	/ SnO_2
	3 mm	45 nm	10 nm	5 nm	42 nm
c)	glass	/ AlO_xF_y	/ Ag	/ NiCr	/ SnO_2
	3 mm	60 nm	12 nm	5 nm	42 nm

confirmed the improved colorimetry in reflection.

In the present context, there is no doubt that the above three stacks described as mathematical modelisations belong to the invention described in D1.

Regarding the specific stacks b) and c) on which appellant II relied for novelty purposes, both consist of the sequence of layers:

glass / AlO_xF_y / Ag / NiCr / SnO_2

i.e. a sequence wherein the reflective metal layer (Ag) is deposited directly onto an aluminum oxyfluoride underlayer, itself deposited directly on to a glass substrate, as in claim 20 of the request at issue.

1.5 It is true that D1 does not explicitly disclose the preparation process of these stacks. However as explained above, the said stacks belong to the invention described in D1. So, in accordance with the established jurisprudence of the boards of appeal that it is necessary to consider the whole content of a citation when deciding the question of novelty, the board has no doubt that the preparation process disclosed for the stacks defined for example in claim 1 of D1 also directly and unambiguously applies to those other stacks which are encompassed by the invention of D1, namely inter alia the stacks b) and c).

1.6 At page 5, lines 1 to 3, D1 discloses that vacuum techniques such as evaporation or cathodic sputtering, possibly with the assistance of a magnetic field, may advantageously be used for depositing the layers.

D1 further discloses (page 5, lines 4 to 14) that, when substrates capable of withstanding high temperatures - such as glass (emphasis added) substrates - are used, it is also possible to deposit some of the layers of the stack, most particularly those based on an oxide or nitride, by pyrolysis techniques in the solid, liquid or gas phase (the last technique then being called CVD for "Chemical Vapour Deposition"). It can be advantageous to combine the two types of techniques,

and thus to deposit the interlayer directly on to the glass of a float-glass ribbon by pyrolysis when it is an oxide or oxyfluoride. In a subsequent step, in particular when the functional layer is metal, more particularly silver, the other layers of the stack can be deposited by sputtering once the glass has been cut up.

D1 finally discloses that when an aluminum oxyfluoride interlayer is chosen, it may be deposited either by sputtering or by pyrolysis, preferably by pyrolysis in the vapour phase using an organometallic precursor.

1.7 In view of the above, the board comes to the view that D1 directly and unambiguously discloses that **when the interlayer is an aluminum oxyfluoride** - as in the above stacks b) and c) - the interlayer can be deposited either by sputtering **or** pyrolysis. So, in order to arrive at the subject-matter of claim 20 at issue, the skilled person has to make a choice between pyrolysis or sputtering. Once the choice of pyrolysis has been made, no further choice has to be made to arrive at the subject-matter of claim 20 at issue, because D1 directly and unambiguously discloses the other features in combination, since it discloses that it **is advantageous to combine the two deposition techniques**, i.e. depositing the interlayer directly on the glass (of a float-glass ribbon) by pyrolysis and then, in a subsequent step, the other layers of the stack by sputtering, **when the interlayer is an oxyfluoride and when the functional layer is metallic**.

From the above considerations, and bearing in mind the established jurisprudence that novelty is not conferred

when a feature results from a single choice made from among a list of alternatives (here: the two alternatives "pyrolysis" or "sputtering"), the board concludes that document D1 when taken as a whole directly and unambiguously discloses a coated glass falling within the scope of claim 20 of the main request.

Thus the subject-matter of claim 20 of the main request is not novel within the meaning of Article 54(1) and (2) EPC.

2. *First auxiliary request - Novelty*

2.1 Claim 18 of this request is distinguished from claim 20 of the main request in that the underlayer has been deposited "by a chemical vapour deposition process".

2.2 As indicated in point 1.5 above, D1 discloses that when an aluminum oxyfluoride interlayer is chosen (as in the stacks b) and c) disclosed at page 8 of document D1), the underlayer may be deposited either by sputtering or by pyrolysis, **preferably by pyrolysis in the vapour phase using an organometallic precursor** (*emphasis added*).

Since "pyrolysis in the vapour phase using an organometallic precursor" is a chemical vapour deposition process and since this preparation process is furthermore described in D1 as preferred, in contrast to the subject-matter of claim 20 according to the main request, no further choice is necessary in order to arrive at the subject-matter of claim 18 at

issue, which is therefore also disclosed directly and unambiguously by document D1.

Claim 18 at issue thus also lacks novelty within the meaning of Article 54(1) and (2) EPC.

3. *Second auxiliary request - Inventive step*

3.1 Claim 16 of this request is distinguished from claim 18 of the first auxiliary request in that the underlayer comprises a silicon oxide or titanium oxide. Novelty was not at issue regarding this claim.

3.2 Inventive step has to be assessed according to the "problem-solution approach" applied by the boards of appeal. So, in the first step, the closest state of the art has to be established and, in agreement with the parties, this is represented by document D2, because it relates - like the contested patent - to a transparent substrate, particularly of glass, coated with a stack of thin layers having at least one metallic layer enabling it to act upon solar radiation and infra-red radiation of long wavelength (D2, lines 3 to 5). D2 furthermore deals with the same problem as the patent in suit, namely the provision of a low emissivity stack with anti-solar properties, which retains these properties after a thermal treatment, such as tempering or bending (page 3, lines 1 to 4).

3.3 D2 (claim 1) discloses a transparent substrate, particularly of glass, provided with a stack of thin layers having at least one metallic layer having properties in the infrared range and two coatings containing dielectric material, the one being located

under and the other over the layer having properties in the infrared range, as well as a protective metallic layer placed immediately over and in contact with the layer having properties in the infrared range. The objective of this sequence of layers is to prevent modification of properties of the stack when the substrate is submitted to a tempering or bending thermal treatment, the second coating containing dielectric material including a barrier layer for the diffusion of oxygen having a thickness of at least 10 nm. The material of the barrier layer is selected from the following materials: silicon compounds SiO_2, SiO_xC_y, SiO_xN_y, nitrides such as Si_3N_4 or AlN, carbides such as SiC, TiC, CrC, TaC. The layer having properties in the infrared range is directly in contact with the underlying dielectric coating.

D2 furthermore discloses (page 4, lines 24 to 30) that the choice of silicon oxide as the dielectric layer in contact with the glass substrate would be an advantageous variation, since this material acts as an efficient barrier against the diffusion of oxygen and alkalis. Its refractive index of about 1.45 being furthermore very close to that of the glass substrate when silicon oxide is deposited directly on the glass, which is the **preferred arrangement** *(emphasis added by the board)*, it hardly interferes with the optical aspect of the layers of the stack.

Regarding the preparation of the stacks according to the examples disclosed in D2, these stacks are obtained by successive deposition of the different thin layers using a cathodic sputtering technique. As described at page 7, lines 12 to 14 of D2, the deposition may

however as well be done by any other technique permitting good control of the layer thicknesses to be obtained.

D2 finally discloses (page 4, lines 44 to 46) that when the first layer of the stack is SiO_2, this can be continuously and directly deposited on a ribbon of float glass, in particular using precursors of the tetraethylorthosilicate type. The board observes that this deposition method is clearly and unambiguously a chemical vapour deposition - as presently defined in claim 16 at stake. D2 however does not explicitly disclose which deposition technique is to be used for the other layers when SiO_2 is deposited in this manner.

3.4 In the light of the disclosure of document D2, appellant I argued that the **problem to be solved** was to be seen in the provision of a low emissivity coated glass having a simpler coating stack, the emissivity of the coated glass not being substantially degraded during heat-treatment.

3.5 As a solution to this problem, the patent in suit proposes the coated glass as defined in claim 16 of this request, characterised in that the multilayer coating comprises:

- an underlayer comprising a silicon oxide or titanium oxide deposited using a chemical vapour deposition process,
- a vacuum deposited reflective metal layer deposited directly on to the underlayer, and
- a vacuum deposited anti-reflection layer.

3.6 The next question to be answered is whether the problem defined under point 3.4 has been solved over the whole scope of claim 16.

In this respect, the board observes that owing to Example 1 of the contested patent, the problem as set by the patentee/appellant I (point 3.4 above) may appear to have been solved, as the stack of Example 1 comprises one layer less than the one defined in claim 1 of D2, and even two layers less than the stacks prepared in the Examples of D2.

The scope of protection of the contested patent is however much broader than the sole disclosure of Example 1, since claim 16 at stake is worded in an open manner as regards the number of layers to be deposited on to the reflective metal layer. Furthermore, in its Example 3, the contested patent - like claim 1 of D2 - also discloses an additional metallic layer (Inconel) between the reflective metal layer and the anti-reflection layer.

So, concerning the simplicity aspect of the problem as put forward by appellant I, this is not solved over the whole scope of claim 16 at stake.

3.7 The problem is therefore to be reformulated in less ambitious terms, namely in the provision of another low emissivity coated glass, the emissivity of which is not substantially degraded during heat treatment.

3.8 In view of the results summarized in Table 3 of the contested patent, which show that the optical properties, in particular the emissivity, of the stacks

prepared in Examples 1 to 3 of the contested patent have not been substantially degraded, the board is satisfied that the problem identified in point 3.7 above has been solved.

3.9 The question which remains to be answered is whether or not the proposed solution is obvious in view of the known state of the art.

3.9.1 Appellant I/patentee contested the argument that the solution as proposed in claim 16 at stake would be obvious, in particular from the disclosure of document D2 alone. It argued in this respect that, on the one hand, the wetting layer (of zinc oxide) located between the underlayer and the metallic reflecting layer was mandatory in D2 and that, on the other hand, the combination of an underlayer deposited by a chemical vapour deposition process with the other layers being deposited under vacuum was not derivable from D2.

3.9.2 The board observes that although a zinc oxide wetting layer is disclosed in all the examples of D2, this does not mean that this feature is mandatory, or in other words, essential for solving the problem underlying the invention described in D2. An indication that said wetting layer is not essential for this purpose is that it is not recited in independent claim 1 of D2.

The fact that the wetting layer is clearly optional, and not considered as an essential feature in document D2, is confirmed in the passage at page 13, lines 32 to 37 of D2, which discloses that "it is important, **if one chooses** (emphasis added) to deposit an "intercalated" oxide layer between the underlayer and the silver layer,

that the oxide material of the layer be chosen so that the thermal treatment does not affect its structure. Therefore ZnO has been chosen in the Examples 1 to 4 illustrating the invention of D2".

3.9.3 Concerning the combination of an underlayer deposited by chemical vapour deposition with the other layers being deposited under vacuum, it is true that this combination of features is not explicitly disclosed in D2.

However - as indicated in point 3.3 above - D2 directly and unambiguously discloses that when the first layer of the stack is SiO_2, this can be continuously and directly deposited on the glass substrate by chemical vapour deposition. Concerning the deposition of the other layers, the skilled person has the choice - as described at page 7, lines 12 to 14 of D2 - among different techniques permitting good control of the layer thicknesses to be obtained. Owing to the fact that in the examples of D2 the layers have been deposited by vacuum sputtering, the skilled person finds in this technique an adequate solution for depositing the other layers of the stack.

3.9.4 In view of the above findings and in the absence of evidence that the deposition of the SiO_2 underlayer by chemical vapour gives rise - in comparison to other deposition techniques - to any improvement in terms of conservation of the emissivity properties of the multilayer coating during a heat treatment, the skilled person thus finds in document D2 - which deals with the same problem as the contested patent - all the information he needs to solve the problem identified in

point 3.7 above. So, he will arrive in an obvious manner at the subject-matter of claim 16 at issue. It follows that the subject-matter of claim 16 does not meet the requirements of Article 56 EPC.

4. Third auxiliary request - Inventive step

4.1 The subject-matter of claim 19 of this request differs from claim 16 of the second auxiliary request in that the underlayer is "*deposited pyrolytically*" instead of being "*deposited using a chemical vapour deposition process*" and in that the underlayer comprises *a "silicon oxide"* instead of a *"silicon oxide or titanium oxide".*

4.2 The board observes that the generic expression "deposited pyrolytically" defined in claim 19 at stake encompasses the specific expression "deposited using a chemical vapour deposition method" which is defined in claim 16 of the second auxiliary request.

As claim 19 at stake furthermore includes the same combination of features as claim 16 of the second auxiliary request, the reasoning set out under point 3. above applies *mutatis mutandis* to the subject-matter of claim 19 at stake, which is therefore not allowable under Article 56 EPC.

5. Since each request on file includes at least one claim which does not meet the requirements of the EPC, none of the requests is allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside

2. The patent is revoked

The Registrar: The Chairman:

C. Vodz G. Raths