

Internal distribution code:

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

**Datasheet for the decision
of 22 October 2025**

Case Number: T 1609/23 - 3.4.02

Application Number: 16704969.1

Publication Number: 3248032

IPC: G02B5/28, C23C14/06, C23C14/10

Language of the proceedings: EN

Title of invention:
NEAR INFRARED OPTICAL INTERFERENCE FILTERS WITH IMPROVED
TRANSMISSION

Patent Proprietor:
Materion Corporation

Opponent:
Viavi Solutions Inc.

Headword:

Relevant legal provisions:
EPC Art. 54(1), 56, 83, 123(2)

Keyword:

Novelty - main request (yes)
Inventive step - main request (yes)
Sufficiency of disclosure - (yes)
Amendments - allowable (yes)

Decisions cited:

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0

Case Number: T 1609/23 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 22 October 2025

Appellant: Materion Corporation
(Patent Proprietor) 6070 Parkland Blvd.
Mayfield Heights, OH 44124 (US)

Representative: Kador & Partner Part mbB
Corneliusstraße 15
80469 München (DE)

Appellant: Viavi Solutions Inc.
(Opponent) 6001 America Center Drive
San Jose, CA 95002 (US)

Representative: Murgitroyd & Company
165-169 Scotland Street
Glasgow G5 8PL (GB)

Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
12 July 2023 concerning maintenance of the
European Patent No. 3248032 in amended form.**

Composition of the Board:

Chairman R. Bekkering
Members: A. Hornung
D. Rogers

Summary of Facts and Submissions

- I. Both the patentee and the opponent appealed against the interlocutory decision of the opposition division maintaining European patent No. 3248032 in amended form.

Opposition had been filed against the patent as a whole and based on the grounds for opposition under Article 100(a) EPC, together with Articles 54(1) and 56 EPC, Article 100(b) EPC and Article 100(c) EPC.

The opposition division had found that the patent as amended according to auxiliary request 12 then on file and the invention to which it related met the requirements of the EPC.

- II. Oral proceedings before the board were held on 22 October 2025.

The patentee requested that the decision under appeal be set aside and the patent be maintained according to claims 1 - 7 of the main request filed on 15 September 2025, with a description comprising paragraphs 1-5, 9-22, 24-32, 34-38 of the patent specification, and paragraphs 6, 23 and 33 filed at the oral proceedings before the board on 22 October 2025, and Figs 1-4 of the patent specification, or alternatively, on the basis of the claims of auxiliary requests 1 to 23, all filed under cover of a letter dated 15 September 2025. The claims of the present main request are identical to those of auxiliary request 6 underlying the appealed decision.

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

III. The following documents, which were relied on in the first-instance opposition proceedings, are referred to in the present decision:

D1: US 2014/0014838 A1,

D3: JP 2013-250318 (reference is made to an English translation of D3, filed by the opponent with the notice of opposition),

D9: "Design of Interference Filters using the European Patent 3248032", declaration of William H. Southwell, 4 March 2022;

D10: "Design of an Interference Filter having a passband with a lower limit of 750 nm using the European Patent 3248032", declaration of William H. Southwell, 8 March 2022;

D11: "Bandpass Filter Design Centered at 750 nm using the European Patent 3248032", declaration of William H. Southwell, 11 March 2023,

D12: US 2003/0039847 A1,

D14: "Inert gas", Wikipedia, filed by the opponent with letter dated 23 March 2023.

The patentee's written submissions are designated P1 to P4 as follows:

P1: statement of grounds of appeal, filed with letter dated 17 November 2023,

P2: letter dated 27 March 2024 (reply to the opponent's statement of grounds of appeal),

P3: letter dated 18 September 2024,

P4: letter dated 15 September 2025.

The opponent's written submissions are designated O1 to O3 as follows:

O1: statement of grounds of appeal, filed with letter dated 22 November 2023,

O2: letter dated 22 March 2024,

03: letter dated 22 September 2025.

IV. Independent claim 1 of the main request reads as follows (features are numbered **1.1** to **1.3** in line with point 12 of the appealed decision, except for the addition of feature **1.2.1***):

"An interference filter (100) comprising:

1.1 a transparent substrate (102);

1.2 a layers stack (110, 112) supported by the transparent substrate, the layers stack comprising plurality [*sic*] of layers of at least:

1.2.1 layers of amorphous hydrogenated silicon (104)

1.2.1* with added nitrogen (a-Si:H,N) and

1.2.2 layers (106, 108) of one or more dielectric materials having a refractive index lower than the refractive index of the amorphous hydrogenated silicon

1.2.3 wherein the layers of one or more dielectric materials include layers (108) of a dielectric material having a refractive index in the range 1.9 to 2.7 inclusive and

1.2.4 wherein the layers of one or more dielectric materials further include SiO₂ layers (106);

1.3 wherein the layers stack is configured to have a passband center wavelength in the range 750-1100 nm inclusive".

Reasons for the Decision

1. Main request - Amendments

The patent according to the present main request is compliant with the requirements of Article 123(2) EPC.

1.1 In the following discussion, down to paragraph 1.4.3, all references to the patent application and the claims are to the "as originally filed" versions, unless otherwise stated.

1.2 According to the opponent, the requirements of Article 123(2) EPC were infringed because claims 1 and 6 of the main request were amended so as to contain subject-matter which extended beyond the content of the application as filed. The board is not convinced by the opponent's arguments for the following reasons.

1.3 Claim 1 of the main request

1.3.1 Present claim 1 comprises *inter alia* the feature of claim 3, i.e. the presence of SiO₂ layers as defined in feature **1.2.4**, but not the features of claim 2, i.e. concrete examples of materials having a refractive index in the range 1.9 to 2.7, on which claim 3 is dependent.

1.3.2 The board concurs with the patentee and the opposition division that a filter comprising layers including SiO₂ without comprising any of the concrete examples of materials as defined in claim 2 has a clear basis in the combination of claims 12 and 14.

1.3.3 The opponent contends that there was no basis in the patent application for adding the feature of claim 3 to claim 1 while leaving out the features of claim 2.

In particular, contrary to the patentee's view, claims 12 and 14 "cannot be relied on for the basis of claim 1 [of the main request] [...] as these claims do not support the additional features of claim 1 [of the main request] [...] in combination with the features of claims 12 and 14" (O2, page 2, last paragraph).

Furthermore, present claim 1 wrongly covered layers of any material having a refractive index in the range 1.9 to 2.7, while paragraph [0027] of the patent application disclosed that the material is Si-compatible. Therefore, "[p]aragraph [0027] further supports the dependency of claim 3 as filed, i.e. that the layers of a dielectric material having a refractive index in the range of 1.9 to 2.7 inclusive must be a Si-compatible material as claimed in claim 2 as filed" (O2, page 4, second paragraph).

The opponent concluded that "[a]s the subject-matter of claims 2 and 3 as filed are inextricably linked both in the claims and in the description, the incorporation of the subject-matter of claim 3 as filed alone represents added matter pursuant to Article 123(2) EPC" (O2, page 4, last paragraph).

- 1.3.4 The board is not convinced by the opponent's arguments. Claim 12 defines a filter comprising features **1.2.1**, **1.2.2** and **1.2.3**. Claim 14 defines feature **1.2.4** and depends directly on claim 12. It follows that the patent application unambiguously defines a filter comprising the combination of features defined in claims 12 and 14, namely features **1.2.1** to **1.2.4**, and this without including the features of claim 2. Therefore, as submitted by the patentee (P1, point 2.1.5) and as explained in the appealed decision, point 14.4, claims 12 and 14 form a basis in the patent application for adding the features of

claim 3 to claim 1, without adding the features of claim 2.

The fact that claims 12 and 14 do not comprise the additional features **1.1** and **1.3** of present claim 1, i.e. a transparent substrate and a passband centre wavelength in the range 750 to 1100 nm, does not prevent the direct and unambiguous disclosure of features **1.2.1** to **1.2.4** from claims 12 and 14. Features **1.1** and **1.3** are merely further limitations of the filter which has already been defined by the features of claims 12 and 14.

The wording in paragraph [0027] of the patent application merely describes an exemplary list of suitable materials having a refractive index between 1.9 and 2.7. Indeed, the wording "some suitable Si-compatible materials [...] include" does not imply that the recited list of materials is exhaustive. Further materials not appearing in the list are not excluded by the wording in paragraph [0027] (see P3, point 2.1.7). Therefore, the patent application does not disclose SiO₂ layers in the interference filter *only* in combination with the materials defined in claim 2. Concerning the feature "Si-compatible" allegedly missing in present claim 1, the board concurs with the opposition division that "[i]f layers were to be used that are not Si-compatible it would appear that the device could not even be fabricated" (appealed decision, point 14.4), i.e. due the fact that the filter comprises amorphous silicon, it is implicit that the material of the layers having a refractive index in the range 1.9 to 2.7 must be Si-compatible.

1.4 Claim 6 of the main request

1.4.1 The board concurs with the patentee and the opposition division that present claim 6 is directly and

unambiguously derivable from claim 10 in combination with paragraph [0036] of the patent application as originally filed.

1.4.2 According to the opponent, present claim 6 comprised added subject-matter for the following reasons:

(a) Paragraph [0036] of the patent application could not form the basis of the present claim 6 because paragraph [0036] described a method for fabricating an interference filter using only silicon-based materials and present claim 6 was not limited to the silicon-based materials, but covered also those materials of present claim 2 which were not silicon-based. Moreover, the last two sentences of paragraph [0032] of the patent application defined further constraints - absent from present claim 6 - applicable when materials other than silicon-based ones were used. Since these constraints were missing, present claim 6 represented an unallowable intermediate generalisation.

Still further, paragraph [0036] of the patent application described a highly specific example in which Si_3N_4 layers alternated with SiO_2 layers, defining a high-pass filter on one side of the substrate and a low-pass filter on the opposite side. It was not permissible to extract and claim only certain features of this embodiment without including all of the features disclosed in paragraph [0036].

(b) "In paragraph [0036], it is explicitly stated that the substrate is 'initially loaded onto the substrate carousel 14', i.e. before depositing the layer stacks and 'flipping' the substrate over. Therefore, paragraph [0036] defines a specific order of steps

which is not reflected in claim 6 as granted" (O3, page 2, last paragraph).

1.4.3 The board is not convinced by the opponent's arguments.

(a) The board concurs with the patentee that the broad method steps of claim 6 are "not linked, let alone inextricably linked, to the specific properties and chemical nature of the layer materials used, but are generally applicable for producing interference filters in accordance with claims 4 and 5" (P1, point 2.1.14). The additional elements disclosed in paragraph [0032] of the patent application relate essentially to how the non-silicon materials are introduced into the sputtering chamber. This aspect is independent of the general method steps defined in claim 6.

(b) Claim 6 does not explicitly define a specific sequence for the method steps. However, as explained by the patentee during oral proceedings, it is implicit for the skilled person that the steps are to be carried out in the following order: features 6.3, 6.2, 6.4 and finally 6.5.

2. Main request - Sufficiency of disclosure

The patent discloses the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 83 EPC).

2.1 The opponent submitted the following arguments to show that the invention was not sufficiently disclosed (cf. appealed decision, points 16.1, 16.3, 16.4, ; O1, point 6; O2, point 3; O3, point 2.1.2):

- 2.1.1 The patent failed to disclose any working example in sufficient detail. In particular, it did not specify the exact placement, material and thickness of the layers.
- 2.1.2 The patent did not sufficiently disclose the exact amounts of hydrogen and nitrogen to be added to the amorphous Si layer in order to achieve the desired effects of increasing the filter transmission while minimizing the concomitant reduction in its refractive index and achieving the claimed passband centre wavelength (O1, point 6.2). In particular, during oral proceedings before the board, the opponent submitted that claim 1 covered interference filters containing very small amounts of nitrogen. However, such very small amounts of nitrogen did not provide the technical effects described in the patent. Therefore, the invention was not sufficiently disclosed over the whole scope of claim 1.
- 2.1.3 The invention of claim 1 could not be carried out over the whole scope of the claim. In particular, claim 1 via feature **1.2.3** defined materials generally by their refractive index (between 1.9 and 2.7), although only a limited list of materials was disclosed in claim 2 and the patent description (O1, point 6.4). Even claim 1 "covers non-working embodiments" (O2, page 6, penultimate paragraph; O3, page 3, penultimate paragraph), because feature **1.2.3** includes elements which are not Si-compatible.
- 2.1.4 During oral proceedings before the board, the opponent argued that claim 1 via feature **1.3** defined a passband interference filter consisting of a single stack of layers. Such a passband interference filter was not sufficiently disclosed in the patent because the patent (paragraph [0032]; claims 4 and 5) only disclosed a passband interference filter consisting of two distinct

high and low band-pass filters, deposited on opposite sides of the substrate.

In writing, the opponent submitted that "there is no proof that a filter in accordance with claim 1 can be achieved without a two-sided filter arrangement of claims 4 and 5" (O1, page 13, second paragraph) and that "no evidence has been provided to support the contention that other configurations are part of the common general knowledge" (O2, page 7, first paragraph; O3, page 3, penultimate paragraph).

2.1.5 For the following reasons, documents D9 to D11 could not be regarded as evidence that the invention as claimed was sufficiently disclosed:

- D9 to D11 were post-filed data and therefore could not be "relied upon to cure this fundamental insufficiency of disclosure present in the application as filed" (O2, page 11, second paragraph).
- The author of D9 to D11 possessed skills exceeding those of the skilled person.
- The filters of D9 to D11 consisted of two filter stacks, one on each side of the substrate, namely a low pass filter stack and a high pass filter stack. Therefore, these filter stacks did not provide evidence that the claimed interference filter, consisting of a single filter stack on one side of the substrate, was feasible.

2.2 The board is not convinced by the above-mentioned opponent's arguments for the following reasons:

2.2.1 Interference filters composed of multiple optical layers have long been designed according to the well-known principles of light interference, involving partial reflection and transmission at the layer boundaries. The board sees no reason to assume that the claimed interference filter is based on principles other than these established ones, and the opponent has neither provided evidence to the contrary nor advanced any arguments to that effect. Therefore, although the patent may lack a detailed description of a working example, the board is convinced that a person skilled in the art of interference filters is able to design a filter as defined in claim 1 merely on the basis of common general knowledge. See also the explanations submitted in writing by the patentee (P2, points 4.2 to 4.6) about how a filter as claimed could be designed by the skilled person "using routine experimentation/modeling", based on "thin film coating design software, such as TfCalc, FilmStar, Optilayer, or EssentialMacLeod" (P2, point 4.5).

In the present case, an insufficiency of disclosure could arise, for instance, from a claimed performance of the filter which cannot be achieved. However, present claim 1 does not define any challenging performance as it only specifies a range for a passband centre wavelength without defining a minimum transmission of the filter.

2.2.2 Paragraph [0033] of the patent discloses ranges for the amounts of hydrogen and nitrogen to be added to the amorphous Si layer. The opponent has not provided any evidence that the skilled person, applying conventional thin-film coating design techniques, would be unable to select appropriate amounts of hydrogen and nitrogen to obtain an interference filter with the desired optical properties. The board likewise sees no reason to doubt that the skilled person would be capable of doing so.

Moreover, as submitted by the patentee during the oral proceedings before the board, in the present invention there is no minimum amount of nitrogen required when doping the Si layer with nitrogen, unlike in cases where nitrogen is added stoichiometrically. The effect of nitrogenation on the optical transmission and the refractive index of the interference filter manifests itself gradually. In any event, since neither the optical transmission nor the refractive index is defined in claim 1, the possible absence of the above-mentioned effect of nitrogenation, due to an insufficient amount of nitrogen, could not be regarded as giving rise to an insufficiency of disclosure. Accordingly, the board concludes that the requirements of Article 83 EPC are fulfilled in this respect.

2.2.3 Contrary to the opponent's allegation, the exemplary materials defined in claim 2 are sufficient to cover materials across the entire range of refractive indices between 1.9 and 2.7. As submitted by the patentee, "[a]ny dielectric material that fulfills [this condition of the refractive index being between 1.9 and 2.7] is, in principle, suitable" (P2, point 4.30) to be used in the claimed interference filter. Moreover, there is no doubt that the skilled person possesses the necessary knowledge to discard, without undue burden, any material having a refractive index between 1.9 and 2.7 that is unsuitable for use in a filter as claimed, for example a material that is not compatible with a Si layer. The opponent neither argued nor provided evidence to the contrary.

2.2.4 The opponent did not provide any evidence in support of its submission that the design of an interference filter composed of a single multilayer stack deposited on one side of the substrate - instead of two stacks deposited

on both sides, as disclosed in the patent - required any specific technical information going beyond the skilled person's common general knowledge.

On the contrary, the board notes that the design of a multilayer passband interference filter deposited on one side of a substrate is based on the same physical principles as that of a filter composed of two multilayer stacks deposited on opposite sides, one acting as a low-pass filter and the other as a high-pass filter. In both cases, the optical design relies on the well-established theory of thin-film interference and the same mathematical modelling of multiple reflections and transmissions within the layer system. No specific evidence is required for this, as these principles form part of the skilled person's common general knowledge.

Thin-film design software routinely used in the art applies these principles by calculating the spectral response from the refractive indices, thicknesses and positions of the layers, irrespective of whether they are arranged on one or on both sides of the substrate. The difference between a single-stack and a double-stack configuration is thus merely structural: in the single-stack arrangement, more layers may be required to achieve the combined low-pass and high-pass performance, whereas in the two-stack configuration these functions are separated.

As submitted by the patentee during the oral proceedings before the board, in a one-sided passband filter the higher number of layers may cause greater bending and thermal expansion of the substrate during deposition. These negative effects, well known to the skilled person, can be mitigated by dividing the filter into two stacks on

opposite sides of the substrate, as would be equally well known to the skilled person.

Accordingly, starting from the disclosure of a two-sided multilayer filter and using common general knowledge and standard thin-film design tools, the skilled person would be able to design an equivalent one-sided filter without undue burden. The absence of an explicit example of a one-sided configuration in the patent does not therefore amount to a lack of disclosure.

Therefore, the board agrees with the patentee's statement that "following the teaching of the opposed patent and using the available software a filter according to the embodiment of claim 1 having the layers stack on one side of the transparent substrate can be designed" (P2, point 4.29).

2.2.5 Documents D9 to D11 were submitted by the patentee to demonstrate that the passband interference filter defined in claim 1 as granted did not require the addition of nitrogen. Since present claim 1 specifies the presence of nitrogen and, for the reasons given above, the board concludes that the invention can be carried out on the basis of common general knowledge alone, so that documents D9 to D11 are no longer relevant.

2.2.6 In conclusion, for the reasons above, "the burden of proof for showing that in fact a lack of sufficient disclosure is given is on the Opponent, and the Opponent has not filed any evidence whatsoever in this regard" (P2, point 4.31).

3. Main request - Novelty

The subject-matter of claim 1 is novel in view of the available prior art (Article 54(1) EPC).

The opponent did not raise any objection of lack of novelty against the subject-matter of claim 1 of the present main request - corresponding to auxiliary request 6 then on file - either in writing or orally during the oral proceedings. The board also sees no reason to doubt that the subject-matter of present claim 1, in particular at least feature **1.2.1*** (added nitrogen), is novel over the available prior art.

4. Main request - Inventive step

The subject-matter of claim 1 involves an inventive step in view of the available prior art (Article 56 EPC).

4.1 D3 as closest prior art

4.1.1 Distinguishing features

(a) It is undisputed that the filter of claim 1 differs from the one of D3 in that the silicon layer comprises hydrogen and nitrogen (features **1.2.1** and **1.2.1***).

(b) In addition, contrary to the opinion of the opponent, D3 does not explicitly disclose that the silicon layer is made of amorphous silicon. The reference to amorphous silicon in paragraph [0002] of D3 relates to the description of the prior art.

However, as further argued by the opponent, there is neither an indication in D3 that special measures were taken to provide crystalline silicon, nor any technical reason to depart from the selection of amorphous silicon as used in the background art

referred to in D3. Therefore, the feature of amorphous silicon layer does contribute to an inventive step.

4.1.2 Technical effect and objective technical problem

As disclosed in paragraph [0019] and figures 2 and 3 of the patent, "adding nitrogen increases the transmission with a reduced concomitant reduction in refractive index", as compared to a Si layer doped exclusively with hydrogen. As further explained in paragraph [0022] of the patent, the reduced reduction of the refractive index thus obtained makes it possible to limit the angular shift of the spectral passband for light passing through the filter layers at an angle.

The objective technical problem to be solved can thus be formulated as increasing the transmission of the interference filter of D3 with a reduced reduction of its refractive index (and thus limiting the angular shift of the passband).

4.1.3 Non-obviousness of the claimed solution

D3 deals with the problem of how to provide "a multilayer filter capable of extracting light of a specific infrared wavelength with a simple configuration and inexpensively while using Si as a film of high refractive index" (D3, [0005]). As stated by the patentee, "D3 is entirely silent on the problem of angular shift of the interference filter described therein" (P1, point 2.4.19).

Therefore, starting from D3, the skilled person would have no motivation to even contemplate seeking a solution to the above-mentioned objective technical problem. If, *arguendo*, they were nevertheless confronted with this problem, "[i]n D3, no hint whatsoever to solving the above

problems is contained" (P1, point 2.4.24). Nor is any solution to this problem disclosed in any of the prior-art documents cited by the opponent. More specifically, the claimed solution, i.e. adding nitrogen to the hydrogenated amorphous silicon layer, is unknown in the prior art.

It follows that the subject-matter of claim 1 involves an inventive step in view of D3 as closest prior art.

4.1.4 Opponent's objections to inventive step

(a) D3 in combination with D12 and common general knowledge

During the oral proceedings before the board, the opponent, referring *inter alia* to paragraphs [0003] and [0004] of the patent, argued that it was common general knowledge to hydrogenate amorphous silicon in order to improve transmission.

Furthermore, with reference to paragraph [0020] of the patent, the opponent submitted that the problem solved by the addition of nitrogen was to further improve transmission. Alternatively, since claim 1 also encompassed very small amounts of nitrogen which did not give rise to any of the technical effects described in the patent (i.e. increased transmission and/or reduced reduction of the refractive index), the problem to be solved could also be seen to provide merely an alternative to hydrogenation. In view of D12, paragraph [0037], doping a-Si:H coatings with nitrogen formed part of the common general knowledge, irrespective of the reason for using the nitrogen dopant.

Therefore, the skilled person, seeking to solve the above-mentioned problems, would have arrived at the claimed

filter in an obvious manner by doping the hydrogenated silicon layer with nitrogen.

(b) D3 in combination with D1 and common general knowledge

During oral proceedings before the board, the opponent argued that the skilled person, confronted with the problem of increasing the filter's transmission while limiting the reduction of the refractive index, would consult D1, since this document disclosed information related to the problem to be solved, namely that "[t]he refractive index decreases with increasing hydrogen flow rate" (D1, paragraph [0043]; figure 5c). In consulting D1, the skilled person would also learn that "silicon is sputtered in the presence of hydrogen (H₂), as well as an inert gas such as argon, to deposit the hydrogenated silicon material as a layer on the substrate" (D1, paragraph [0037]). With reference to D14, second paragraph, disclosing that "[p]urified nitrogen and argon gases are most commonly used as inert gases", the opponent further argued that another well-known inert gas used in sputtering techniques was nitrogen. By using nitrogen instead of argon as the inert gas in the sputtering process, at least some nitrogen atoms would attach to the other sputtered elements and form a layer made of a-Si:H,N. In writing, the opponent stated that "such small amounts of nitrogen encompassed by the claims, may inevitably be present in a-Si:H layers formed in the presence of nitrogen, which may be used as an obvious alternative to the inert gas employed in the process disclosed in D1" (O3, page 9, last paragraph).

Hence, by sputtering silicon in the presence of hydrogen and nitrogen, the skilled person would, according to the opponent, obviously arrive at the claimed subject-matter.

4.1.5 Opponent's objections on inventive step - unpersuasive

- Re: D3 in combination with D12 and common general knowledge

The board is unable to follow the opponent's line of reasoning in its entirety. While the first part of the opponent's reasoning intended to demonstrate that hydrogenating a silicon layer would be obvious in view of common general knowledge – as exemplified by the disclosure in paragraphs [0003] and [0004] of the patent – is found convincing by the board, the subsequent reasoning aimed at showing why the addition of nitrogen to an already hydrogenated silicon layer would be obvious is not conclusive for the following reasons:

- (a) In the first place, contrary to the opponent's assumption, there is no evidence that the information indicating that doping a hydrogenated silicon layer with nitrogen increases the layer's transmission formed part of the common general knowledge. In particular, the opponent's reference to paragraph [0020] of the patent cannot be regarded as evidence of such knowledge, since this paragraph is part of the patent itself and not of any prior art disclosure. Therefore, the skilled person would not have had the knowledge to envisage further increasing the transmission of a hydrogenated silicon filter by doping it with nitrogen.
- (b) In the second place, if the skilled person were attempting to increase the filter's transmission by providing an alternative to hydrogenation and were actually considering nitrogen as a dopant, this would imply that the hydrogen dopant was to be replaced by the nitrogen dopant rather than being added to it. In

other words, the skilled person would not arrive at a silicon filter comprising both hydrogen and nitrogen as dopants.

- (c) In the third place, as put forward by the patentee during oral proceedings before the board, D12 concerns a problem entirely different from that addressed by the present invention, namely "to provide an interference filter in which temperature-induced changes in optical performance are minimized" (D12, paragraph [0009]). The disclosure of D12 essentially relates to a solution based on the use of a polymeric substrate instead of a glass substrate. This kind of technical considerations are far away from those relating to the present patent. Therefore, the skilled person would neither have identified D12 as relevant nor, a fortiori, considered its teaching when seeking to solve the above-mentioned problem. Even more so because D12 does not contain any specific teaching that nitrogen as a dopant increases the filter's transmission, but merely states that "[i]n another embodiment of the invention, the a-Si:H coatings are doped with various elements known in the art, such as, but not limited to, nitrogen, germanium, phosphorous, boron and carbon". There is no obvious reason why the skilled person would have specifically selected nitrogen as a dopant from this open-ended list of five possible elements.

- (d) In the fourth place, the disclosure in D12, paragraph [0037], according to which nitrogen is a possible dopant of hydrogenated silicon, does not, contrary to the opponent's assertion, form part of the common general knowledge. Indeed, a single patent document such as D12 cannot, by itself, be regarded as evidence of common general knowledge.

- Re: D3 in combination with D1 and common general knowledge

The board is not persuaded by the opponent's argumentation. As submitted by the patentee during oral proceedings before the board, the skilled person, starting from D3 and faced with the problem of increasing the filter's transmission without unduly reducing the refractive index, would have had no reason to consult D1. Indeed, D1 is not only silent about nitrogen as a dopant, but even unrelated to the above-mentioned problem. Therefore, the skilled person has no obvious reason to look for a solution in D1.

Concerning the question of whether nitrogen is a well-known inert gas which could function as an alternative to any other inert gas, the patentee rightly drew the attention to the definition of an inert gas given in D14, first paragraph: "An inert gas is a gas which does not undergo chemical reactions under a set of given conditions". The board agrees with the patentee that, in general, a gas is inert only under specific conditions. In particular, nitrogen may act as an inert gas under certain conditions of the layer deposition process, but not necessarily in every such process. For instance, even in the patent itself (paragraph [0026]), the exemplary inert gases disclosed are argon and xenon, but not nitrogen. Hence, as argued by the patentee, it remains uncertain whether the deposition process described in the patent and in D1 are carried out under conditions in which nitrogen would function as an inert gas. Therefore, it is not obvious to replace argon, used as an inert sputtering gas in the deposition of a-Si:H according to paragraph [0037] of D1, with nitrogen. Furthermore, assuming that nitrogen,

initially employed only as an inert gas, would actually dope the a-Si:H layers is an unfounded assumption.

4.2 D1 as closest prior art

4.2.1 Distinguishing features

(a) It is undisputed that the filter of claim 1 differs from the one of D1 in that the hydrogenated silicon layer comprises nitrogen (feature **1.2.1***).

(b) In addition, contrary to the opinion of the opponent, as submitted by the patentee (see e.g. P3, points 4.1 to 4.6), D1 does not disclose the combination of features **1.2.3** and **1.2.4**: "D1 does not contain any teaching whatsoever that in the filter stack shown in Figure 6 more than two layers of different materials may be present" (P3, point 4.4).

Indeed, D1, with reference to figure 6 and paragraph [0046], discloses an optical filter comprising an interference filter stack (610), which includes hydrogenated silicon layers (611) and lower-refractive-index layers (612), a substrate (620) and an anti-reflection coating (630). "[T]he lower-refractive-index material is a dielectric material, typically, an oxide. Suitable lower-refractive-index materials include silicon dioxide (SiO₂), aluminium oxide (Al₂O₃), titanium dioxide (TiO₂), niobium pentoxide (Nb₂O₅), tantalum pentoxide (Ta₂O₅), and mixtures thereof, i.e., mixed oxides" (D1, paragraph [0051]). In other words, in D1, a SiO₂ layer is presented as an *alternative* to any other so-called lower-refractive-index layer (i.e. a layer having a refractive index lower than that of hydrogenated silicon), whereas claim 1 defines the presence of a

SiO₂ layer *in addition to* another lower-refractive-index layer.

4.2.2 Objective technical problem

As explained in point 4.1.2 above, the objective technical problem solved by feature **1.2.1*** can be formulated as increasing the transmission of the interference filter of D3 with a reduced reduction of its refractive index (and thus limiting the angular shift of the passband).

Concerning the combination of features **1.2.3** and **1.2.4**, "it is disclosed [in the patent] to obtain reduced angular shift in interference filters operating in the 750-110 nm range by substituting a higher refractive index material for SiO₂ [(i.e. feature **1.2.3**)] in some low index layers of the interference filter. According to the invention, the substitute layer is a dielectric layer that has a refractive index in the range 1.9 to 2.7" [(i.e. feature **1.2.4**)] (patent description, paragraph [0023]). Therefore, the objective technical problem solved by the combination of features **1.2.3** and **1.2.4** can be formulated as "providing an interference filter with a filter stack providing an improved, i.e. reduced, angular shift [as compared to a filter stack using only silicon and SiO₂ layers]" (P1, point 2.4.8).

4.2.3 Non-obviousness of the claimed solution

The board agrees with the patentee that for the reasons provided in P1, points 2.4.9 and 2.4.14, the subject-matter of claim 1 comprises an inventive step.

In particular, "nowhere in D1 an indication is contained that providing an interference layers stack as characterized by claim 1 [,i.e. the combination of

features **1.2.3** and **1.2.4**,] would solve the above described objective technical problem of providing a filter stack with improved angular shift" (P1, point 2.4.9). "In addition, the subject-matter of claim 1 requires a more complicated filter structure than the simpler two layer filter construction as used in D1, requiring (at least) one additional layer in the interference stack. This will make the claimed interference filter more complicated and costly to produce, and only in hindsight with knowledge of the invention it was clear that the benefits of the three layer stack construction involving the materials as given in claim 1 outweigh the drawbacks of producing said structure" (P1, point 2.4.14).

4.2.4 Opponent's objections to inventive step

(a) According to the opponent, referring to the case law of the boards of appeal, "the wording of the claims should typically be given its broadest technically sensible meaning" (O1, page 16, third paragraph). The opponent further referred to claim 4 of the patent defining a layers stack including a first stack on one side of the transparent substrate and a second layers stack on the opposite side of the transparent substrate. "Therefore, the layers stack of claim 1 must be broadly interpreted to encompass a layers stack which may be continuous and disposed on one side of the substrate, or discontinuous and disposed on opposing sides of the substrate" (O1, page 14, second paragraph).

On the basis of this interpretation of the claim wording, the opponent concluded that the optical filter shown in figure 6 of D1, comprising a first layers stack (610, 611, 612) and a second layers stack

(630), anticipated the combination of features **1.2.3** and **1.2.4**.

- (b) In case that features **1.2.3** and **1.2.4** were not disclosed in combination in D1, the opponent argued that the solution to the objective technical problem of providing an improved, i.e. reduced, angular shift, was known from D1, paragraph [0050], and that paragraph [0051] of D1 disclosed lower-refractive-index material solving the problem. "Therefore, starting from the embodiment of D1 disclosed in Figs. 7 or 8 and described in paragraphs [0058] to [0065] and faced with the objective technical problem, the skilled person would be taught by D1 itself (paragraphs [0050] and [0051]) that further inclusion of dielectric layers with a somewhat higher refractive index that is still lower than that of a-Si:H can provide a reduced angular shift. In this regard, as the inclusion of two or more lower-refractive-index materials is anticipated by D1 [...] and on the basis of the disclosure of paragraph [0051], the skilled person would select a dielectric material with a refractive index in the range of 1.9 to 2.7 inclusive [(feature **1.2.3**)] to at least partially substitute the SiO₂ layers [(feature **1.2.4**)] of Figs. 7 or 8 in order to reduce the angular shift" (O1, page 23, first paragraph).

In O2, page 20, third paragraph, the opponent further argued that "D1 does not exclude the possibility of the lower-refractive-index layers comprising more than one of the dielectric materials disclosed in paragraph [0051]". Actually, according to the opponent, "partial substitution of the SiO₂ layers in the optical filter of granted claim 1 is nothing more than a routine design modification" (O2, page 21, first paragraph).

(c) The opponent argued that adding nitrogen to a-Si:H layers was obvious in view of paragraph [0037] of D1. The opponent's reasoning is essentially that given in point 4.1.4 (b) above.

4.2.5 Opponent's objections on inventive step - unpersuasive

- Re Objection (a)

While the board does not dispute the opponent's reference to the boards of appeal case law establishing that the wording of the claims should be given its broadest technically sensible meaning, the board disagrees with the opponent's contention that in D1 the anti-reflection layer stack (630) forms part of the passband interference filter (610). The respective optical functions are completely independent of each other: an anti-reflection multilayer is designed to reduce as much as possible the reflection of light at an interface between two regions having different indices of refraction, whereas a multilayer passband interference filter is designed to transmit light as much as possible within a certain wavelength range and to block as much as possible light outside said wavelength range. It follows that the SiO₂ layer in the anti-reflection coating (630) of D1 does not form part of the passband interference filter of D1. In claim 4, the layers formed on both sides of the substrate form both part of the passband interference filter of claim 1, having both the function of transmitting light as much as possible within a certain wavelength range and blocking as much as possible light outside said wavelength range. Therefore, the skilled person, even when interpreting the claim's wording in its broadest meaning, would not arrive at the conclusion that the filter of D1, figure 6, anticipated the filter of claim 1.

- Re Objection (b)

Contrary to the opponent's contention, paragraphs [0050] and [0051] of D1 do not disclose that layers of a third type of material are added to the embodiments shown in figures 7 and 8 of D1, already comprising low-refractive-index layers made of SiO₂. These paragraphs merely disclose that, instead of using SiO₂ layers having a very low refractive index (approximately 1.45), another material having a "somewhat higher refractive index" could be used in order to reduce the angle shift of the passband filter. However, the possibility of replacing only some of the SiO₂ layers, i.e. designing a filter comprising layers made of three materials, is not mentioned in D1. Therefore, the skilled person receives no hint from D1 to modify the embodiments of figures 7 or 8 as defined in features **1.2.3** and **1.2.4**.

The opponent's statement in O2 that designing a passband filter comprising layers with an intermediate refractive index in addition to SiO₂ layers was "a routine design modification" is merely an unsubstantiated allegation. As argued by the patentee, adding an additional material to a functional multilayer filter increases the complexity and cost of fabrication, which would discourage the skilled person from implementing such a modification as a routine design measure.

5. For the reasons set out above, the board is satisfied that the patent as amended according to the present main request and the invention to which it relates meet the requirements of the EPC.

Order

For these reasons it is decided that:

The decision under appeal is set aside.

The case is remitted to the opposition division with the order to maintain the patent as amended in the following version:

Description:

Paragraphs 1 to 5, 9 to 22, 24 to 32 and 34 to 38 of the patent specification and paragraphs 6, 23 and 33 filed at the oral proceedings before the Board on 22 October 2025.

Claims:

Claims 1 to 7 of the main request filed under cover of a letter dated 15 September 2025.

Drawings:

Figs. 1 to 4 of the patent specification.

The Registrar:

The Chairman:



L. Gabor

R. Bekkering

Decision electronically authenticated