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**Datasheet for the decision
of 25 September 2019**

Case Number: T 1956/16 - 3.3.03

Application Number: 10191930.6

Publication Number: 2371889

IPC: C08K5/13

Language of the proceedings: EN

Title of invention:

Aerogel, and composition and method for manufacture of the aerogel

Patent Proprietor:

Samsung Electronics Co., Ltd.

Opponent:

Covestro Deutschland AG

Relevant legal provisions:

EPC Art. 54, 84, 123(2)

Keyword:

Novelty - Main request and first auxiliary request (no)
Adaptation of the description - Second auxiliary request (Yes)



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Case Number: T 1956/16 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 25 September 2019

Appellant: Samsung Electronics Co., Ltd.
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 20 June 2016
revoking European patent No. 2371889 pursuant to
Article 101(3) (b) EPC.**

Composition of the Board:

Chairman D. Semino
Members: D. Marquis
F. Blumer

Summary of Facts and Submissions

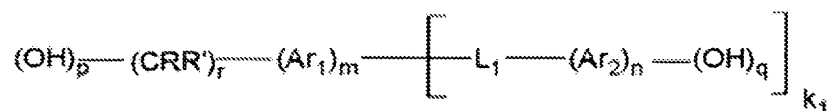
- I. The appeal by the proprietor lies against the decision of the opposition division posted on 20 June 2016 to revoke European patent No. 2 371 889.
- II. The patent was opposed on the grounds that its subject matter lacked novelty and inventive step. The decision was based on a main request and three auxiliary requests filed with letter of 29 April 2016.

The main request contained 18 claims, independent claims 1, 6 and 18 reading as follows:

"1. A composition for manufacturing an aerogel comprising a benzoxazine moiety-containing polybenzoxazine polymer, the composition comprising an aryl alcohol compound having at least three hydroxyl groups, an amine compound having at least two amine groups, an aldehyde compound, and a solvent,

wherein the aryl alcohol compound having at least two hydroxyl groups is selected from the group consisting of aryl alcohol compounds represented by the following Chemical Formula 1:

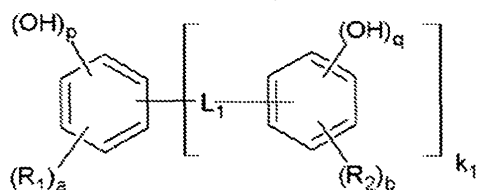
Chemical Formula 1



wherein, in the above Chemical Formula 1, each Ar₁ and Ar₂ are independently a substituted or unsubstituted C6 to C30 aryl group, a substituted or unsubstituted C3 to C30 heteroaryl group, or a substituted or unsubstituted C7 to C30 alkylaryl group, such that each Ar₁ and Ar₂ comprises at least one

unsubstituted carbon at the alpha position with respect to a hydroxyl group,
 each L_1 is independently a single bond, O, CO, S, SO₂, a substituted or unsubstituted C1 to C30 alkylene group, a substituted or unsubstituted C3 to C30 cycloalkylene group, a substituted or unsubstituted C6 to C30 arylene group, a substituted or unsubstituted C7 to C30 alkylarylene group, a substituted or unsubstituted C1 to C30 heteroalkylene group, a substituted or unsubstituted C2 to C30 heterocycloalkylene group, or a substituted or unsubstituted C2 to C30 alkenylene group,
 each R and R' is independently hydrogen or a substituted or unsubstituted C1 to C10 alkyl group,
 r is an integer ranging from 0 to 4,
 n and m are independently integers ranging from 1 to 5, and n+m is determined by the valence of L_1 ,
 p and q are independently integers ranging from 1 to 4, and p+q is 2 or more provided that when k_1 is 0, p is 2, 3 or 4, and
 k_1 is an integer ranging from 0 to 4, and
 aryl alcohol compounds represented by the following
 Chemical Formula 2:

Chemical Formula 2



wherein, in the above Chemical Formula 2,
 each L_1 is a single bond, O, CO, S, SO₂, a substituted or unsubstituted C1 to C30 alkylene group, a substituted or unsubstituted C3 to C30 cycloalkylene group, a substituted or unsubstituted C6 to C30 arylene group, a substituted or unsubstituted C7 to C30 alkylarylene group, a substituted or unsubstituted C1

to C30 heteroalkylene group, a substituted or unsubstituted C2 to C30 heterocycloalkylene group, or a substituted or unsubstituted C2 to C30 alkenylene group,
each R₁ and R₂ is independently hydrogen, a hydroxyl group, a substituted or unsubstituted C1 to C10 alkyl group, a substituted or unsubstituted C1 to C10 alkoxy group, NR_xR_y, OR_x, NH(CO)R_x, OCOR_x, a substituted or unsubstituted C6 to C18 aryl group, or CH=CR_x, wherein the R_x and R_y are independently hydrogen or a substituted or unsubstituted C1 to C10 alkyl group,
p and q are independently integers ranging from 1 to 4, and p+q is 2 or more, provided that when k₁ is 0, p is 2, 3 or 4,
a and b are independently integers ranging from 1 to 3, and
k₁ is an integer ranging from 0 to 4,
such that at least one unsubstituted carbon is present at the alpha position with respect to a hydroxyl group in the R₂-substituted benzene ring of Chemical Formula 2."

"6. An aerogel comprising a benzoxazine moiety-containing polybenzoxazine polymer, wherein the polymer comprises a reaction product of an aryl alcohol compound having at least two hydroxyl groups, and an amine compound having at least two amine groups of a composition comprising the aryl alcohol compound having at least three hydroxyl groups, the amine compound having at least two amine groups, an aldehyde compound, and a solvent."

"18. A method of making an aerogel, comprising:
reacting an aryl alcohol compound having at least three hydroxyl groups, an amine compound having at least two

amine groups, and an aldehyde compound, in the presence of a solvent, to form a wet gel, and drying the wet gel to produce an aerogel."

The claims of auxiliary request 1 corresponded to the claims of the main request with the amendment in claims 1, 6, 12 and 13 of the definition of the "aryl alcohol compound having at least two hydroxyl groups" in an "aryl alcohol compound having at least three hydroxyl groups".

Auxiliary request 2 contained 13 claims, independent claims 1 and 13 corresponding to claims 6 and 18 of the main request.

The claims of auxiliary request 3 corresponded to the claims of auxiliary request 2 with the amendment in claims 1, 2 and 3 of the definition of the "aryl alcohol compound having at least two hydroxyl groups" in an "aryl alcohol compound having at least three hydroxyl groups".

III. The decision of the opposition division, as far as it is relevant for the present case, can be summarized as follows:

(a) D3 (WO 03/011931) disclosed a composition comprising a solvent, a diamine, an aldehyde and a triphenol, wherein the triphenol was trisphenol-PA (claim 9 and claim 17 of D3). Trisphenol-PA was an aryl alcohol compound having three hydroxyl groups and corresponded to chemical formula 1 of claim 1 of the main request with $p=2$, $r=0$, $m=1$, $n=1$, Ar_1 a C_{14} alkylaryl, AR_2 a C_{15} alkylaryl, L_1 a single bond, $q=1$ and $k_1=1$. The main request therefore lacked novelty over D3.

- (b) Claim 1 of auxiliary request 1 differed from claim 1 of the main request only in that an obvious correction was made as to the amount of hydroxyl groups on the aryl alcohol compound. This correction did not circumvent the novelty objection based on D3. Consequently, the subject-matter of claim 1 of auxiliary request 1 also lacked novelty over D3.

- (c) The claims of auxiliary request 2 were restricted to aerogels and their method of preparation. The amendments in auxiliary request 2 fulfilled the requirements of Article 123 (2) and (3) EPC. Since D3 failed to disclose aerogels, the claimed subject matter was novel with respect to D3.

- (d) D1 was the closest state of the art for the claimed aerogels. The claimed subject-matter differed from D1 in that an aryl alcohol with at least three hydroxyl groups was used. Since there was no suggestion in the state of the art cited by the opponent to manufacture aerogels with aryl alcohols having at least three hydroxyl groups, the subject matter of auxiliary request 2 was inventive.

- (e) No adapted description corresponding to the claims of auxiliary request 2 was filed during the opposition proceedings and the description of the patent as granted included embodiments falling outside the subject-matter of auxiliary request 2. Auxiliary request 2 did not fulfil therefore the requirements of Article 84 EPC.

- (f) Auxiliary request 3 differed from auxiliary request 2 in that an obvious correction was made as to the

amount of hydroxyl groups on the aryl alcohol compound. The conclusions as to the substantive issues regarding auxiliary request 2 also applied to auxiliary request 3. However no adapted description was filed during the opposition proceedings. Auxiliary request 3 did also not fulfil the requirements of Article 84 EPC.

- IV. The proprietor (appellant) lodged an appeal against that decision and provided with the statement of grounds of appeal a new main request as well as three auxiliary requests each accompanied by a corresponding adapted description.

The claims of the main request corresponded to the claims of auxiliary request 1 before the opposition division with a further amendment regarding the definition of p ("provided that when k_1 is 0, p is 3 or 4") and $p+q$ (" $p+q$ is 3 or more") in claims 1, 12 and 13.

Auxiliary request 1 corresponded to the main request decided upon by the opposition division.

Auxiliary request 2 in appeal corresponded to auxiliary request 3 before the opposition division with a further amendment regarding the definition of p ("provided that when k_1 is 0, p is 3 or 4") and $p+q$ (" $p+q$ is 3 or more") in claims 2, 3, 12 and 13.

Auxiliary request 3 in appeal corresponded to auxiliary request 2 before the opposition division.

V. The arguments of the appellant can be summarized as follows:

Main request and auxiliary request 1

- (a) The conclusion of the opposition division regarding the lack of novelty of claim 1 of the present main request over D3 was incorrect because Trisphenol-PA disclosed in D3 was not an aryl alcohol of chemical formula 1 as defined in claim 1 of the main request.
- (b) In particular, if one was to follow the analysis of chemical formula 1 of claim 1 with regard to Trisphenol-PA as made by the opposition division, it would follow that the group Ar₁ was an ethyl-group carrying two phenyl rings in the 1-position and Ar₂ was a phenyl group linked to a propyl group in the 2-position of the propyl group, which in turn carried a further phenyl group in the 2-position.
- (c) Paragraph 37 of the description of the patent in suit however defined an alkylaryl group as an aryl group linked via an alkylene moiety, i.e. one aryl group linked through one alkyl group. It was then clear that the residues assigned by the opposition division to the residues Ar₁ and Ar₂ clearly fell outside this definition as both residues comprised two aryl groups. Even if one was to assume that an alkylaryl group could contain more than one aryl group, this definition would still not cover the residue assigned by the opposition division to Ar₂ since the residue assigned by the opposition division to Ar₂ comprised an aryl group linked to

an alkyl group which in turn was linked to an aryl group.

(d) Claim 1 of the main request was thus novel over D3. The same arguments equally applied to claim 1 of auxiliary request 1.

Auxiliary requests 2 and 3

(e) The adapted descriptions corresponding to the claims of the auxiliary requests 2 and 3 provided with the statement of grounds of appeal addressed the objections of the opposition division under Article 84 EPC.

- VI. The opponent (respondent) did not file a response to the grounds of appeal nor any arguments or objection in appeal.
- VII. The appellant requested in writing that the decision under appeal be set aside and that the patent be maintained on the basis of the main request or, alternatively, on the basis of any one of auxiliary requests 1 to 3, all requests as filed with the statement setting out the grounds of appeal of 20 October 2016.
- VIII. The respondent requested in writing that the appeal be dismissed.

Reasons for the Decision

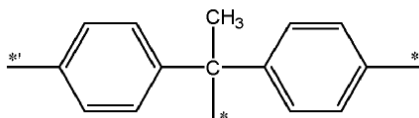
Main request

1. Novelty

1.1 The decision of the opposition division with regard to lack of novelty over D3 was contested by the appellant on the grounds that the aryl alcohol Trisphenol-PA, which is disclosed in claim 9 of D3, did not correspond to an aryl alcohol of chemical formula 1 as defined in claim 1 of the main request.

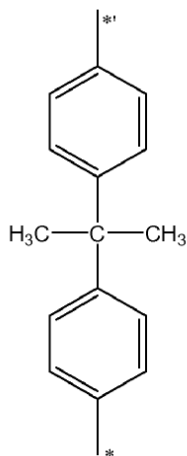
1.2 In particular, the appellant submitted in appeal that claim 1 of the main request was novel over D3 because the rests Ar_1 and Ar_2 identified as

Ar_1



and

Ar_2



by comparing the structural formula of Trisphenol-PA with chemical formula 1 as defined in claim 1 of the main request were not alkylaryl groups in the sense provided in paragraph 37 of the patent in suit. These rests Ar₁ and Ar₂ in the case of Trisphenol-PA contained two aryl groups attached to an alkyl residue and were not according to the definition given in the patent in suit which implied that an alkylaryl group was a group having one aryl group linked to one alkyl group. Furthermore, the rest Ar₂ identified above comprised an aryl group linked to an alkyl group in turn linked to an aryl group and thus was not according to the definition provided in paragraph 37 of the patent in suit which required an aryl group linked via an alkylene moiety.

1.3 The term alkylaryl is used in claim 1 among other groups defining the rests Ar₁ and Ar₂ of chemical formula 1 limiting the aryl alcohols present in the composition. No definition is provided in claim 1 of the term alkylaryl apart from the additional information that the rests Ar₁ and Ar₂ can be substituted or unsubstituted C7 to C30 alkylaryl groups. Also, neither the latter wording in claim 1 nor the context in which Ar₁ and Ar₂ appear in chemical formula 1 indicate that an alkylaryl according to claim 1 of the main request should be construed as a group containing one aryl group linked to one alkyl group only.

1.4 Yet, the appellant relied on paragraph 37 of the patent in suit defining the term alkylaryl as an aryl group linked to an alkylene moiety. However, the consideration of the wording used in paragraph 37 does not limit the definition of alkylaryl to the presence of one aryl group linked to one alkyl group. Above all,

the use of the indefinite article "an" in the sentence "an aryl group linked via an alkylene moiety" in paragraph 37 does not imply that only one of each aryl or alkylene moieties are present in the alkylaryl group.

1.5 That is also confirmed by the overarching wording set out in paragraph 28 of the description, from which the definitions contained in paragraph 37 including that of an alkylaryl group cannot be read in isolation. In particular, paragraph 28 concerns the terminology used in the patent in suit, underlining that "the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise". It is at this stage of the patent in suit made clear to the reader that the definitions provided throughout the patent in suit should be understood with the plural form in mind. Applied to the definition of alkylaryl provided in paragraph 37, it is apparent that an alkylaryl may contain more than one alkyl or aryl groups.

1.6 Since nothing indicates in paragraph 37 nor in claim 1 of the main request that the plural form should not be relevant to the definition of the term arylalkyl, there is no reason to limit its definition to the presence of one aryl group linked to one alkyl group only as the appellant does.

1.7 Thus, the rests Ar_1 and Ar_2 identified above under point 1.2 fall under the definition of a substituted or unsubstituted C7 to C30 alkylaryl group provided in claim 1 of the main request. It is also clear from the above that each Ar_1 and Ar_2 may be a multivalent group and that the definition provided in the patent in suit does not impose a limitation on how the alkylene moiety

and the aryl groups are attached to the neighbouring elements in chemical formula 1.

- 1.8 Under these circumstances the Board concludes that Trisphenol-PA is an aryl alcohol according to claim 1 of the main request and that, no other point being disputed, claim 1 of the main request lacks novelty over D3.

Auxiliary request 1

2. Novelty

- 2.1 The claims of auxiliary request 1 in appeal corresponded to the claims of the main request decided upon by the opposition division. With regard to claim 1 of the present main request which sets out that the aryl alcohol compound is "an aryl alcohol having at least three hydroxyl groups", claim 1 of auxiliary request 1 sets out, in the part of claim 1 defining chemical formula 1, that the aryl alcohol is "an aryl alcohol having at least two hydroxyl groups". Furthermore, claims 1, 12 and 13 of auxiliary request 1 set out that the parameters p and q defining the chemical formulas 1 and 2 in these claims are so defined that "p+q is 2 or more" and "p is 2, 3 or 4" whereas these parameters are defined as "p+q is 3 or more" and "p is 3 or 4" in claim 1 of the present main request.

- 2.2 The wording chosen for the definition of the aryl alcohol and the definition given for the parameters p and q in claim 1 of auxiliary request 1 are broader than those used in claim 1 of the main request so that the wording of auxiliary request 1 does not alter the reasoning provided above for the main request with

regard to novelty over D3. Indeed the appellant did not provide any separate argument with regard to novelty over D3 for auxiliary request 1. The Board concludes that claim 1 of auxiliary request 1 also lacks novelty over D3.

Auxiliary request 2

3. Auxiliary request 2 in appeal pertained to aerogels and corresponds to auxiliary request 3 before the opposition division with a further amendment regarding the definition of p ("provided that when k_1 is 0, p is 3 or 4") and $p+q$ (" $p+q$ is 3 or more") in claims 2, 3, 12 and 13. Auxiliary request 3 before the opposition division was found to meet the requirements of Articles 123(2), (3), 54 and 56 EPC in the contested decision. The additional amendments in claims 2, 3, 12 and 13 of auxiliary request 2 regarding the definition of p and $p+q$ are further limitations and do not alter the conclusion of the opposition division. Also, no objections were raised in appeal proceedings against auxiliary request 2. The Board does therefore not see a reason to deviate from the decision of the opposition division with regards to auxiliary request 2.

4. The description filed with the claims of auxiliary request 2 corresponded to the description as originally filed as well as to the description of the granted patent with additional amendments reflecting the claims of auxiliary request 2. In particular, the references to compositions for the manufacture of aerogels were deleted and the definition of the number of hydroxyl groups on the aryl alcohol as well as the definition of the parameters p and $p+q$ in chemical formulas 1 and 2 were adapted to the definitions provided in the claims. The description of auxiliary request 2 does therefore

not contain any embodiment that does not correspond to the claims of the same request. The Board thus finds that the amended description of auxiliary request 2 satisfies the requirements of Articles 84 and 123(2) EPC and overcomes the objection which led to the revocation of the patent. Also, no objection was raised against that version of the description in appeal.

5. The Board concludes that auxiliary request 2 satisfies the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent on the basis of the following documents:
 - Claims 1 to 13, filed as Auxiliary Request 2 with the statement setting out the grounds of appeal of 20 October 2016;
 - Description: pages 1 to 26 as filed with the statement setting out the grounds of appeal of 20 October 2016 under the heading "Auxiliary Request 2";
 - Figures 1, 2, 3A, 3B, 4 and 5 as published on pages 21 to 26 of the patent specification.

The Registrar:

The Chairman:



B. ter Heijden

D. Semino

Decision electronically authenticated