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D E C I S I O N
of 15 November 1994

Case Number: T 0047/92 - 3.3.3

Application Number: 81104321.5

Publication Number: 0041703

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Language of the proceedings: EN

Title of invention:
Process for preparing copolymers

Patentee:
Sumitomo Naugatuck Co., Ltd.

Opponent:
Bayer AG, Leverkusen Konzernverwaltung RP Patente Konzern
Naamloze Vennootschap DSM

Headword:
Inventive step

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0047/92 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 15 November 1994

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office dated 26 November 1991 revoking European patent No. 0 041 703 pursuant to Article 102(1) EPC.**

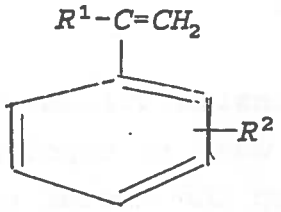
Composition of the Board:

Chairman: F. Antony
Members: W. Kaltenegger
W. M. Schar

Summary of Facts and Submissions

1. The present appeal lies against the Decision of the Opposition Division, given on 26 November 1991, to revoke European patent No. 41 703 of Sumitomo Naugatuck Co., Ltd., Claim 1 in its granted version reading as follows:

"A process for the emulsion polymerization of an α-alkylstyrene represented by the formula



wherein R^1 is a C^1-C^3 alkyl group and R^2 is a hydrogen atom, a C^1-C^3 alkyl group or a halogenated C^1-C^3 alkyl group, and an unsaturated nitrile copolymerisable therewith in a weight proportion of 70:30 to 80:20 in the presence of a radical initiator, characterized in that at the stage of completion of the introduction of the monomers, the amount of unreacted unsaturated nitrile in the reaction system is not less than 31 % by weight of the total amount of unreacted monomers in the system."

II. In earlier proceedings, the patent in suit (granted on application No. 81 104 321.5, filed on 4 June 1981 and claiming Japanese priorities of 5 June 1980 and 2 May 1981) had been opposed by Bayer AG and Naamloze Vennootschap DSM, on the grounds of lacking novelty and inventive step, and of insufficiency. The Opposition Division had then held that the claimed subject-matter was novel, but the disclosure was insufficient (Article 100(b) EPC), no ruling having been given on

inventive step. Following an appeal against that decision, an Appeal Board had set it aside, holding that the claimed subject-matter was indeed sufficiently disclosed, and remitting the case to the Opposition Division for a decision on the point of inventive step.

III. In its decision now under appeal, the Opposition Division held that the claimed subject-matter was lacking in inventive step in view of

(D4) EP-A-419 and
(D5) US-A-3 991 136.

According to its considerations, the problem underlying the patent in suit was, in copolymers of the type here in question, to keep the amount of monomers still present at completion of the polymerisation reaction to a low level, without the necessity of expensive techniques such as stripping. The solution proposed by the patent in suit, i.e. to effect the monomer addition in such a manner that the amount of unreacted nitrile at completion of the addition of monomers is at least 31 weight percent of the entire amount of unreacted monomers, was obvious for the following reasons: D4 as well as D5 dealt with the same problem as the patent in suit. D5 achieved this by addition of a third, highly reactive monomer towards the end of the polymerisation; whereas D4 - which makes reference to D5 - proposed instead to add a further amount of a radical forming compound, emphasising that there should still be considerable amounts of monomeric nitrile present at that stage. It was therefore obvious to initially retain part of the monomeric nitrile and add it later, as envisaged by the patent in suit.

IV. On 3 January 1992, the Patentee (Appellant) filed a Notice of Appeal against that latter decision and paid the prescribed fee. He requested that the decision under appeal be set aside and the patent in suit upheld as granted. An initial request for refund of the appeal fee was later withdrawn. A Statement of Grounds of Appeal was received on 26 March 1992.

In challenging the decision under appeal, the Appellant emphasised that D5 - which incidentally contained no working example employing alpha-methyl-styrene - required a "third", i.e. a different monomer, which was positively not provided according to the patent in suit. The solution proposed by D4 - addition of further radical former - was unable to solve the underlying problem in the case of high contents of alpha-methyl-styrene. Hence neither of these documents contained a pointer to the claimed process. The Board's question, during oral proceedings held on 15 November 1994, whether the proposed solution was not suggested by common technical knowledge such as the law of mass action was answered by the remark that the actual reaction involved here was too complex to allow the application of such purely theoretical considerations.

V. The Respondents (Opponents) relied to a large extent on the reasons of the decision under appeal. In doing so, Bayer emphasised that the highly reactive "third" monomer which D5 taught to add towards the end of the polymerisation was said to have a low boiling point (column 8, lines 19 to 21) and could, e.g., be a derivative of an unsaturated monobasic acid (column 2, lines 61 to 62); acrylonitrile was such a low boiling derivative. DSM pointed out that when, at the final stage of polymerisation, as disclosed by D4, there was some unreacted alpha-methyl-styrene, but no more acrylonitrile left, there was clearly no further

copolymerization possible and it was thus obvious to add part of the acrylonitrile at that stage only, in order to use up some of the residual alpha-methyl-styrene; the numerical value given, in Claim 1 could not render this obvious measure inventive.

The Respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. The sole issue to be decided is the existence or absence of an inventive step.

3. The patent relates to a process for the emulsion polymerisation of alpha-alkyl-styrenes and unsaturated nitriles, in particular alpha-methyl-styrenes (AMS) and acrylonitrile (AN). Because of their good heat resistance polymers with a high content of AMS are desirable. However, due to the poor reactivity of AMS these polymers tend to have a considerable residual content of AMS monomer at the end of the polymerisation process, resulting in deterioration of thermal properties and health hazard. For removing such residual monomer from the polymer, costly physical separation processes were previously used. Thus, the aim has been to lower the residual content of unreacted AMS by simple and economic means.

D5 has achieved this by introducing, at the end stage, an additional, third reactive monomer. This has the drawback that the third monomer, being different in chemical nature from the main two monomers, may alter

the physical and technological properties of the final polymer and, in any case, causes additional expenses for storage and for the feeding into the reaction system.

D4 seeks to avoid these disadvantages and proposes to add to the polymerisation system an additional quantity of radical former, yielding polymers which consist only of AMS and AN units. In the view of the Board, this constitutes the closest piece of prior art.

The problem of the patent in suit can be seen in the provision of an alternative solution. The Board is satisfied that this problem is solved by the measures indicated in Claim 1 of the patent in suit, i.e. by regulating the concentration of acrylonitrile in the system such that at the stage of completion of the introduction of the monomers, the amount of unreacted unsaturated nitrile in the reaction system is not less than 31 % by weight of the total amount of unreacted monomers in the system.

4. It is generally known in the art that the progress of a reaction in most cases depends on the concentration of the reactants. In particular, in a binary reaction normally the concentration of both reactants has an influence such that increased concentrations promote the reaction. Through the progress of the reaction both reactants are consumed.

4.1 Most commonly there is an interest in using up one of the reactants to the largest possible degree, and the standard way to achieve this is to add to the reaction system an excess of the other reactant. This practice can be theoretically based on kinetic considerations and on the law of mass action, but normally it is applied as a matter of routine without giving much thought to the theoretical background of the specific reaction. It thus

appears prima facie obvious for the skilled person to try adding the reactant other than the one whose concentration it is intended to minimise. These general considerations are fully supported by D4 and D5.

4.2 D5 teaches that the amount of residual monomers in polymers obtained by emulsion polymerisation of a styrene and an acrylonitrile (preferred ratio 60-85:40-15, see column 3, lines 16 to 22) can be efficiently decreased by addition of a reactive monomer at a time near the completion of the polymerisation.

It is true that, as both Respondents argue, acrylonitrile is formally not excluded as the third monomer in the disclosure of D5. However, when reading the definition "derivatives of unsaturated monobasic acids", the skilled person will not as a matter of course think of acrylonitrile. Therefore the Board, in line with the Appellant, has no doubt that the actual teaching of D5 is to a third monomer which is different from the first and the second monomer (the unsaturated nitrile). Hence, in the opinion of the Board, D5 teaches that the unwanted residual monomers can be conveniently removed by providing a suitable additional coreactant, but does not, taken alone, render the subject-matter of the patent in suit obvious.

4.3 On the other hand, while D4 does not teach the addition of a third monomer, it discloses specifically that low values of residual AN at the final polymerisation step lead to a virtual stop of the reaction (Examples 11, 12 and 13; see in particular page 14, lines 12 to 15 and 22 to 24, and Table 4; page 4, lines 4 to 11). Therefore, addition, towards the end of the polymerisation, of AN instead of the third monomer of D5 lends itself readily for effecting the removal of residual AMS. Table 4 also indicates that the above effect becomes even more

important when the overall content of AMS in the polymer is increased. It is exactly polymers with such a high content of AMS at which the patent in suit aims.

4.4 A further feature of the characterising part of Claim 1 is the proportion of AN that should be present in the unreacted monomers at the relevant moment. The Board is satisfied that the most desirable quantitative amount for that proportion may easily be determined by simple experiments requiring no more than normal professional skill. The said amount will normally be a range of a certain width rather than a single value. Besides, the 31 % minimal value of the patent in suit simply corresponds to a 1:1 molar ratio of AMS and AN and will be within or near that range. Arriving as such a value does not require an inventive step.

In summary, the proposed solution of the problem underlying the patent in suit as defined in Claim 1 does not involve an inventive step.

4.5 While Claim 2 could be said to fall together with Claim 1 upon which it depends, the Board has nevertheless considered whether it contains a patentable feature. It is clear to the skilled person that monomers trapped within polymer particles already formed will diffuse more easily to the surface (and react there) when these particles are smaller than when they are larger. Polymers in the form of smaller particles therefore will contain less residual AMS and accordingly will have improved thermal properties (cf. D4, page 1, lines 12 to 13). Selecting a specific small particle size and conducting the process such as to obtain this size is in easy reach of a person skilled in the art. Hence, Claim 2 does not contribute to inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

E. Görgmaier

The Chairman:

F. Antony