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**Datasheet for the decision
of 17 January 2007**

Case Number: T 1124/04 - 3.3.03

Application Number: 98124056.7

Publication Number: 1013671

IPC: C08F 8/00

Language of the proceedings: EN

Title of invention:

Functionalized syndiotactic styrene/para-alkylstyrene
copolymer

Patentee:

INDUSTRIAL TECHNOLOGY RESEARCH INSTITUTE

Opponent:

THE DOW CHEMICAL COMPANY

Headword:

-

Relevant legal provisions:

EPC Art. 123(2), 84, 56

Keyword:

"Inventive step (no) (main request, auxiliary request V, IX,
X) "

"Amendments - added subject-matter (yes) (auxiliary
requests I-IV, VI-VIII) "

"Claims - clarity (no) (auxiliary request VIII) "

Decisions cited:

T 0577/97, T 0360/01

Catchword:

-



Case Number: T 1124/04 - 3.3.03

D E C I S I O N
of the Technical Board of Appeal 3.3.03
of 17 January 2007

Appellant: INDUSTRIAL TECHNOLOGY RESEARCH INSTITUTE
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 19 July 2004
revoking European patent No. 1013671 pursuant
to Article 102(1) EPC.

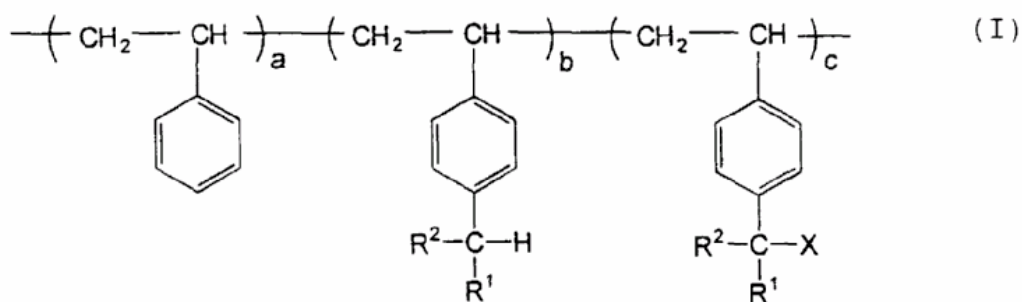
Composition of the Board:

Chairman: R. Young
Members: W. Sieber
E. Dufrasne

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 1 013 671, in respect of European patent application no. 98 124 056.7, in the name of Industrial Technology Research Institute, filed on 17 December 1998, was published on 28 November 2001 (Bulletin 2001/48). The granted patent contained 12 claims, whereby Claim 1 read as follows:

"A functionalized syndiotactic styrene/para-alkylstyrene copolymer, having the formula of



wherein

R¹ and R² are independently selected from the group consisting of hydrogen, alkyl, primary and secondary haloalkyl,

X is a functional group is selected from the group consisting of a functional group containing halogen, metal, oxygen, sulfur, silicon, nitrogen, carbon, phosphorus, and mixtures thereof,

a ranges from 10 to 30000,

b ranges from 0 to 30000, and

c ranges from 1 to 30000."

Dependent Claims 2-12 were directed to preferred embodiments of the functionalized copolymer of Claim 1.

II. A notice of opposition was filed by The Dow Chemical Co. on 27 August 2002 requesting revocation of the patent in its entirety on the grounds of Article 100(a) EPC (lack of novelty and lack of inventive step).

The opposition was supported by the following documents:

D1: EP-A-0 591 823;

D2: US-A-5 189 125;

D3: US-A-5 543 484; and

D4: US-A-5 548 029.

III. During prosecution of the case before the opposition division the proprietor filed amended sets of claims, namely a main, first and second auxiliary request.

(a) The claims of the main request corresponded to the granted claims except that the lower limit for index b in Formula (I) of Claim 1 was amended to 1.

(b) Claim 1 of the first auxiliary request differed from Claim 1 as granted in that "halogen" in the list for the functional group X was substituted by "bromine".

(c) Claim 1 of the second auxiliary request differed from Claim 1 as granted in that the functional group X was defined as being "an alkali or alkaline earth metal, is selected from the group consisting of alkoxides, phenoxides and

carboxylates, is selected from the group consisting of thiolates, thiophenolates, thioethers, thiocarboxylates, dithiocarboxylates, thioureas, dithiocarbamates, xanthates and thiocyanates, is selected from the group consisting of silanes and halosilanes, is selected from the group consisting of malonates, cyanides, is selected from the group consisting of amides, amines, carbazoles, phthalimides, pyridines, maleimides and cyanates, or is a phosphine".

- IV. By a decision which was announced on 7 July 2004 and issued in writing on 19 July 2004, the opposition division revoked the patent.
- (a) According to the opposition division, Claims 1 of the main and the first auxiliary request did not meet the requirements of Article 123(2) EPC.
 - (b) Claim 1 of the second auxiliary request met the requirements of Article 123 and Article 54 EPC.

With respect to inventive step, the nearest prior art was considered to be syndiotactic styrene/p-chloromethylstyrene copolymers which were taught by D1. The description of the patent in suit showed that these copolymers, known from D1, had the same improved adhesion and compatibility as the functionalized styrene/p-alkylstyrene copolymers claimed in Claim 1 of the second auxiliary request. Thus, the objective problem to be solved over D1 was to provide alternative functionalized styrene/p-alkylstyrene copolymers. This problem

was solved by replacing the chlorine of the syndiotactic styrene/p-chloromethylstyrene copolymers of D1 by another functional group. This was normally done by a process described in D3. Since, however, it had not been demonstrated that the functionalization was associated with an unexpected technical effect, the claimed subject-matter was obvious over D1 and D3 (Article 56 EPC).

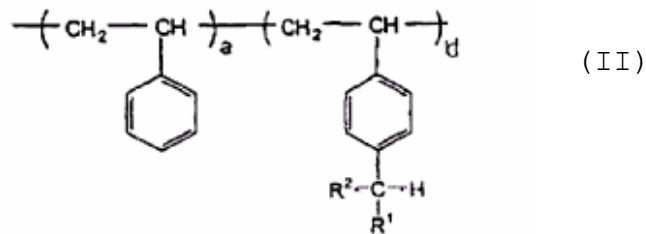
V. On 17 September 2004, the appellant (proprietor) filed a notice of appeal against the above decision with simultaneous payment of the prescribed fee. The statement of grounds of appeal was filed on 29 November 2004. With the same letter the appellant re-filed Claims 1-12 as granted as main request and auxiliary requests I-VIII. In the following, reference is made to Claims 1 of the auxiliary requests only. The dependent claims are not of importance for this decision and will therefore not be discussed in further detail.

(a) Claim 1 of auxiliary request I corresponded to Claim 1 as granted, except that the following product-by-process feature has been introduced at the end of the claim:

"..., and which is obtainable by subjecting an unfunctionalized styrene/p-alkylstyrene copolymer comprising benzylic protons to a functionalization reaction thereby partially substituting said benzylic protons with X wherein X has the meaning indicated".

(b) Claim 1 of auxiliary request II further specified the product-by-process feature:

"... and which is obtainable by subjecting a syndiotactic styrene/p-alkylstyrene copolymer of formula (II) comprising benzylic protons

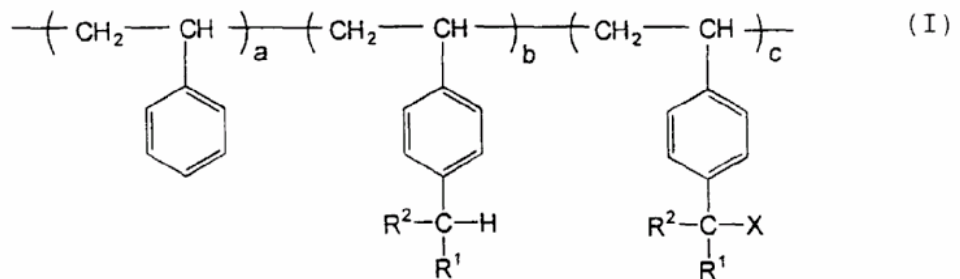


wherein a, R¹ and R² have the meaning indicated and d = b + c,

to a functionalization reaction thereby partially substituting the benzylic protons with X wherein X has the meaning indicated".

- (c) Claim 1 of auxiliary request III corresponded to granted Claim 1 reformulated as a method of preparing a functionalized styrene/p-alkylstyrene copolymer:

"Method of preparing a functionalized syndiotactic styrene/para-alkylstyrene copolymer, having the formula of



wherein

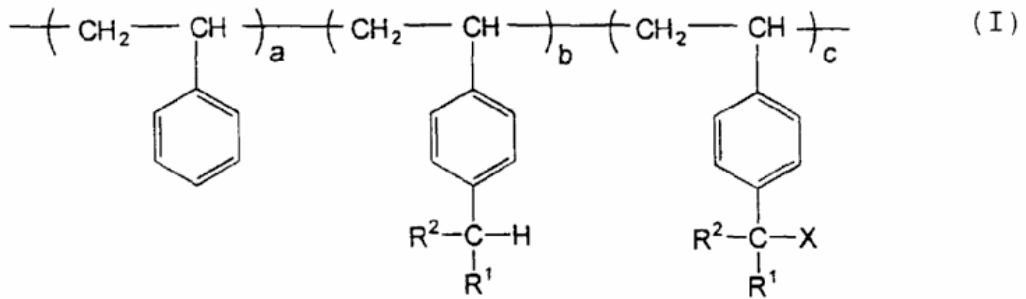
R¹ and R² are independently selected from the group consisting of hydrogen, alkyl, primary and secondary haloalkyl,
X is a functional group is selected from the group consisting of a functional group containing halogen, metal, oxygen, sulphur, silicon, nitrogen, carbon, phosphorous, and mixtures thereof,
a ranges from 10 to 30,000,
b ranges from 0 to 30,000, and
c ranges from 1 to 30,000,
by subjecting an unfunctionalized styrene/p-alkylstyrene copolymer comprising benzylic protons to a functionalization reaction thereby partially substituting said benzylic protons with X wherein X has the meaning indicated."

- (d) Claim 1 of auxiliary request IV corresponded to the Claim 1 of auxiliary request III except that the unfunctionalized styrene/p-alkylstyrene copolymer was further defined by formula (II) as in Claim 1 of auxiliary request II.
- (e) Claim 1 of auxiliary request V corresponded to Claim 1 of the second auxiliary request before the opposition division (point III(c), above).
- (f) Claim 1 of auxiliary request VI corresponded to Claim 1 of auxiliary request V except that the product-by-process feature of Claim 1 of auxiliary request I (see point V(a), above) had been added at the end of the claim.

(g) Auxiliary request VII was identical with auxiliary request VI.

(h) Claim 1 of auxiliary request VIII read as follows:

"A functionalized syndiotactic styrene/paramethylstyrene copolymer, having the formula of



wherein

R¹ and R² are independently selected from the group consisting of hydrogen, alkyl, primary and secondary haloalkyl,

X is -COOH, OH, NH₂, M or COOM and M is alkali or alkaline earth metal,

a ranges from 10 to 30,000,

b ranges from 0 to 30,000, and

c ranges from 1 to 30,000."

VI. The written submissions of the appellant filed with the statement of grounds of appeal can be summarized as follows:

(a) D1 was directed to a thermoplastic resin composition comprising a modified styrenic polymer in which a styrenic polymer having syndiotactic configuration was combined with a compound having at least one unsaturated group and at least one

polar group. The starting material for making the modified styrenic polymer included a copolymer of styrene and substituted styrene (page 3, lines 56-57). The list of substituted styrenes included halogenated alkylstyrene such as chloromethylstyrene (page 4, line 7). However, D1 failed to specify the constitution of the halogenated alkylstyrenes. Thus, D1 did not disclose syndiotactic styrene/p-chloromethylstyrene copolymers as incorrectly assumed by the opposition division. Also the modified styrenic polymers obtained as a reaction product did not fall within the scope of the patent in suit. For example, when the styrene/p-methylstyrene copolymer in Preparation Example 2 was modified with maleic anhydride, the starting material was modified under the quite "extreme" reaction conditions at unspecified positions.

- (b) D2 disclosed a process for producing syndiotactic styrene copolymers comprising copolymerizing at least one styrene-based monomer (A') and a different styrene-based monomer (B') whereby at least one of these monomers must contain a substituted phenyl group. The generic disclosure of monomer (A') and (B') did not anticipate the specific composition of the claimed functionalized syndiotactic styrene/p-alkylstyrene copolymers.
- (c) The opposition division's assessment of inventive step was based on the erroneous assumption that D1 taught syndiotactic styrene/p-chloromethylstyrene copolymers. In fact, D1 provided modified styrenic polymers of unspecified composition and

constitution which were characterized by the process of their manufacture. The polymers of D1 were thus completely different from the highly stereoregular polymers of the patent in suit having a well defined constitution. The object of the patent in suit was to increase the adhesion to highly polar substrates such as large surface area metal substrates or to improve the compatibility with other functionalized, highly polar polymers. D1 neither suggested the polymers of the patent in suit nor did it disclose that the modified polymers had improved adhesion to or compatibility with polar polymers. Neither was the claimed subject-matter obvious in view of a combination of D1 with any of D2-D4.

- (d) D2 generically disclosed functionalized syndiotactic styrene copolymers and was therefore considered by the appellant as the closest prior art. It sketchily suggested that the copolymers obtained could be further modified by organic chemical techniques such as chloromethylation. The main focus in D2 was, however, on preparing pre-functionalized syndiotactic styrene copolymers rather than substituting such polymers subsequently. D2 addressed the problem of providing heat and chemical resistant materials useful in the production of moulded articles which was different from the object underlying the patent in suit so that the person skilled in the art would not have selected D2 as a starting point. Therefore, the claimed subject-matter was not obvious over D2 or in view of a combination of D2 with any of D3 and D4.

VII. In a letter dated 18 March 2005, the respondent (opponent) stated that it would not provide any further arguments in detail since the opposition division's grounds for revoking the patent were sound and all the auxiliary requests were formally not allowable.

VIII. On 17 January 2007, oral proceedings were held before the board at which the respondent, as announced in the letter dated 13 December 2006, was not represented. Since it had been duly summoned, however, the oral proceedings were continued in its absence in accordance with Rule 71(2) EPC.

(a) The focus of the discussion was on inventive step. The appellant considered D1 to represent the closest prior art. Starting from D1, the claimed subject-matter was not obvious from the cited prior art. The chairman drew the appellant's attention to D2 which appeared to be a much more appropriate starting point for the assessment of inventive step. Particular reference was also made to D3 and D4 which described functionalization reactions on polymers containing p-alkylstyrene groups.

(b) Subsequent to the discussion of auxiliary requests I to VIII, the appellant filed auxiliary requests IX and X.

Claim 1 of auxiliary request IX corresponded to Claim 1 as granted where X was restricted to metal.

Claim 1 of auxiliary request X corresponded to Claim 1 as granted where X was restricted to an alkali or alkaline earth metal.

- IX. The appellant requested that the decision under appeal be set aside and the patent be maintained as granted (main request), or, in the alternative,
- on the basis of one of the auxiliary requests I-VIII (all filed on 29 November 2004), IX or X (both filed at the oral proceedings).
- X. The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal complies with Articles 106 and 108 EPC and Rule 64 EPC and is therefore admissible.

Main request (claims as granted)

2. *Novelty (main request)*
- 2.1 D1 discloses a thermoplastic resin composition which comprises as principal components (A) a styrenic resin and (B) an inorganic filler. Component (A) comprises a modified styrenic polymer in which a styrenic polymer having syndiotactic configuration is combined with a compound having at least one unsaturated group and at least one polar group or a mixture of that modified styrenic polymer and a styrenic polymer having syndiotactic configuration (Claim 1).

The modified styrenic polymer of component (A) can be obtained by bonding the modifying agent, ie the compound having at least one unsaturated group and at least one polar group, to a syndiotactic styrenic raw material. Various processes are available for the production of the modified styrenic polymer including, for example, a process wherein a styrenic polymer and the modifying agent are melt kneaded at 150-350°C to proceed with reaction by the use of a roll mill, a Banbury mixer or an extruder, and a process in which the aforesaid components are reacted with heating in a solvent such as benzene, toluene or xylene, whereby the preferred process is melt kneading in the presence of a radical generating agent (page 5, lines 20-30).

- 2.1.1 The starting raw material for making the modified styrenic polymer of component (A) can be a syndiotactic homopolymer as can be taken from the enumeration of homopolymeric materials on page 3, lines 27-40. The starting material can also be a syndiotactic copolymer of styrene and substituted styrene (page 3, lines 56-57). The list of substituted styrenes disclosed on page 4, lines 4-8 includes halogenated alkylstyrene such as chloromethylstyrene. Although D1 envisages as a possible starting material a syndiotactic copolymer of styrene and chloromethylstyrene, this disclosure is not novelty destroying to the subject-matter of Claim 1 as granted, first of all because D1 fails to specify the constitution of the halogenated alkylstyrenes, and in particular the constitution of chloromethylstyrene. Thus, the term "chloromethylstyrene" includes o-chloromethylstyrene, m-chloromethylstyrene and p-chloromethylstyrene. Since a generic disclosure does

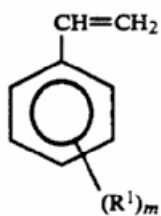
not normally take away the novelty of any specific example (eg Case Law of the Boards of Appeal of the European Patent Office, 4th edition, I.C.3.2.6), D1 does not equate to a disclosure of a syndiotactic copolymer of styrene and p-chloromethylstyrene.

2.1.2 The subject-matter of the granted claims is also novel over Preparation Examples 1-3 of D1 where syndiotactic styrene/p-methylstyrene copolymers were treated with maleic anhydride in an extruder at 300°C. Such a method employing "quite extreme" reaction conditions cannot be used to control the positions of the functional groups. And indeed, D1 aims at a modification of the starting material **at unspecific positions**, for example in the main chain, in the benzene ring or on terminal positions of the chain (page 5, lines 32-33). Thus, it is highly unlikely that the reaction products of Preparation Examples 1-3 of D1 exhibit a well-defined constitution, and certainly not a constitution where the maleic anhydride would be bonded essentially exclusively to the p-methyl group in the benzene ring. In this context, the board notes that D1 omits any structural characterization of the modified reaction products.

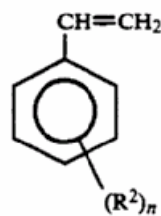
2.1.3 It follows from the above that neither the general disclosure of D1 nor the specific preparation examples of D1 disclose a functionalized syndiotactic styrene/para-alkylstyrene copolymer as claimed in the granted claims. Consequently, the subject-matter of the granted claims is novel over D1.

2.2 D2 is directed to a process for producing syndiotactic styrene copolymers which comprises copolymerizing at

least one styrene-based monomer represented by the general formula (A') and a different styrene-based monomer represented by the general formula (B'):



(A')



(B')

wherein R^1 is a hydrogen atom, a halogen atom, or an oxygen, nitrogen, sulphur, phosphorus or silicon atom-containing group, m is 1, 2 or 3, and when m is 2 or 3, R^1 s may be the same or different, and wherein R^2 is a hydrogen atom, a halogen atom, C_1 - C_{20} alkyl group or an oxygen, nitrogen, sulfur, phosphorus or silicon atom-containing group, n is 1, 2 or 3, and when n is 2 or 3, R^2 s may be the same or different, provided that the styrene-based monomer of the general formula (B') excludes the same as that of the general formula (A'). This means that at least one these monomer types must contain a substituted phenyl group.

The styrene polymers of D2 have a degree of polymerization of not less than 5, preferably not less than 10 (column 5, lines 63-65). Representative examples of resulting copolymer units are shown in column 4, lines 18-41 of D2 and include, *inter alia*, a styrene unit and halogen-substituted alkylstyrene units, such as p-chloromethylstyrene, m-chloromethylstyrene unit and o-chloromethylstyrene units (lines 29-31). This enumeration of monomeric units effectively amounts to a list for monomer (A') and a list for monomer (B'). Such a general disclosure of two lists for (A') and (B')

does not disclose for novelty purpose any specific combination of the starting materials, in particular not the combination of styrene and p-chloromethylstyrene which would lead to a copolymer falling within the scope of Claim 1 as granted (eg Case Law of the Boards of Appeal of the European Patent Office, 4th edition, I.C.4.1.1(b)). Since, furthermore, the concrete examples of D2 are directed either to homopolymers (Examples 1-21, 23-28) or to copolymers which are not functionalized styrene/p-alkylstyrenes copolymers (Examples 22, Examples 1C-12C), the subject-matter of Claim 1 is novel over D2.

2.3 It is correctly stated in section 7.7 of the reasons of the decision under appeal that D3 and D4 are directed to copolymers comprising a substantial amount of α - and isoolefin, respectively. Thus, D3 and D4 are not pertinent to the claimed subject-matter as far as novelty is concerned.

2.4 In summary, the subject-matter of Claim 1 as granted, and by the same token the subject-matter of Claims 2-12 is novel over the cited prior art, namely D1-D4.

3. *The patent in suit, the technical problem (main request)*

3.1 The patent in suit is directed to a functionalized syndiotactic styrene/para-alkylstyrene copolymer (paragraph [0001] of the patent specification). Furthermore, it is stated in paragraph [0006] that "(i)n comparison with the unfunctionalized syndiotactic styrene polymer, the functionalized syndiotactic styrene/p-alkylstyrene copolymer of the present invention has a better adhesion to many substrates and

a better compatibility with other polymers". It is, however, conspicuous to the board that there is not a single example in the patent in suit showing any effect at all. Examples 1-8 describe the synthesis of syndiotactic poly(styrene/p-methylstyrene) and Examples 9-17 the functionalization of poly(styrene/p-methylstyrene), ie oxidation, bromination, carboxylation and silylation. Apart from the fact that the alleged effect is not demonstrated, the aim of the patent in suit is rendered even more diffuse by the breadth of granted Claim 1, in particular by the great variety of the functional group both with respect to its nature (X covers a vast variety of functional groups) and its amount (it is possible to have only one monomer unit containing the functional group for 60 000 other monomer units, ie 30 000 styrene and 30 000 p-alkylstyrene units). Therefore, the claimed subject-matter is divorced from any specific performance and will merely provide the effect of the respective functional group. Hence, the aim of the patent in suit can only be seen in the provision of a functionalized syndiotactic styrene/para-alkylstyrene copolymer.

- 3.2 As set out in point 2.2, above, D2 discloses the preparation of syndiotactic styrene copolymers by copolymerizing monomers (A') and (B') whereby at least one monomer must contain a substituted phenyl group. In case of the syndiotactic styrene/p-methylstyrene copolymers of Examples 1C-4C, the substituent of the phenyl group is a methyl group. If, however, the substituent in the phenyl group is a functional group, the resulting polymer can be widely used as a **functional polymer** (column 6, line 68 to column 7, line 3). In other words, the method of D2 can provide

in a one-step reaction functional polymers by copolymerising "pre-functionalized" monomers. Examples for this preparation of functional polymers in a one-step reaction are given in Examples 9C-12C where styrene is copolymerized with p-fluoro-, p-chloro- and p-bromostyrene.

However, D2 does not only disclose this "direct" method of preparing functional polymers, it mentions also in column 6, lines 51-58 that *"(i)t is well known that various substituents are introduced into aromatic rings of styrene polymers by organic chemical techniques such as chloromethylation. The styrene polymers having various substituents in the aromatic ring thereof of the present invention can be prepared by the above method using the styrene polymers of the present invention as a base polymer while maintaining the tacticity thereof"* (emphasis added). This statement is, in the board's view, a clear indication that the copolymers of D2 can also be used as starting materials for further functionalization reactions, whereby it is explicitly mentioned that the tacticity of the copolymers will be maintained. Thus, D2 discloses a further method of preparing functionalized syndiotactic copolymers, namely a two-step reaction where a syndiotactic copolymer is formed in the first step and functionalised in a subsequent step by organic chemical reactions.

Hence, D2 discloses not only copolymers which are structurally closely related to the claimed subject-matter, it is also directed to the preparation of functionalized syndiotactic copolymers. Therefore, it is considered to represent the closest prior art.

The appellant's argument that D2 could not be considered as the closest prior art because it did not address the specific problem of adhesion and compatibility must fail because the alleged specific problem cannot be taken into account for the reasons given in point 3.1, above.

- 3.3 Since the board is at a loss to recognize any technical effect which goes beyond what is addressed in D2, the objective technical problem to be solved over the closest prior art can only be seen in the provision of further functionalized syndiotactic copolymers.

The board has no doubt that this objective technical problem is solved by the claimed subject-matter.

4. *Inventive step (main request)*

- 4.1 It remains to be decided whether the proposed solution, namely the combination of monomer units set out in Claim 1 as granted, is obvious from the prior art.
- 4.2 As set out in point 3.2, above, the closest prior art, D2, teaches that functionalized syndiotactic copolymers can be prepared by direct copolymerization of "pre-functionalized" monomers. Apart from the specific monomer combinations in the examples, D2 discloses in column 4, lines 18-41 an enumeration of representative compounds that can be used as monomers (A') and (B') in the process of D2, whereby styrene and p-chloromethylstyrene are specifically mentioned (see point 2.2, above). Faced with the problem of providing further functionalized syndiotactic copolymers, a

person skilled in the art would try monomer combinations envisaged by D2, and inevitably arrive at something falling within the scope of Claim 1 as granted, namely a syndiotactic copolymer obtained from the copolymerization of styrene and p-chloromethylstyrene. Since no specific technical effect is associated with this combination, it is merely an arbitrary selection from the general disclosure of D2 which is devoid of any inventive merit.

4.3 In addition, the claimed subject-matter is obvious from another point of view. As explained in point 3.2, above, the person skilled in the art would learn from D2 not only the one-step method for preparing functionalized syndiotactic copolymers (ie copolymerizing of "pre-functionalized" monomers) but also a two-step reaction where a syndiotactic copolymer is formed in the first step and which is functionalized in a subsequent step by organic chemical reactions. Faced with the problem of providing further functionalized syndiotactic copolymers, the person skilled in the art would consider the syndiotactic styrene/p-methylstyrene copolymers prepared in Examples 1C-4C, 6C and 7C of D2 as the ideal starting points for further functionalization because the pendant benzylic group in these copolymers is a reactive site which can be used for further reactions, for example oxidation or halogenation. These reactions are basic organic chemistry and do not involve any inventive ingenuity. Furthermore, they have already been applied in the polymer field.

D3, for example, uses the versatility of benzylic protons to selectively convert the benzylic protons to

various functional groups, such as -COOH, -OH, -NH₂, -Cl, -Br, -M, -COOM (M = metals, eg Li, Na, K and Ca), under mild conditions into copolymers comprising an α -olefin units and p-alkylstyrene units (column 8, lines 1-28). A similar teaching with respect to the versatility of the benzylic protons of p-alkylstyrene units can be found in D4 for a copolymer of an isoolefin and a p-alkylstyrene. As pointed out in column 9, line 1 to column 10, line 6, a benzylic bromine group is obtained by selective bromination of the p-alkylstyrene unit of the copolymer. Such a benzylic halogen functionality constitutes a very active electrophile that can be converted to many other functionalities via nucleophilic substitution reaction.

Thus, the functionalization of the styrene/p-methylstyrene copolymers is obvious from D2 in combination with common general knowledge and/or in combination with D3 and D4.

The applicant's argument that the person skilled in the art **could** but not **would** modify the closest prior art in this way is not convincing. The claimed subject-matter adds up to nothing more than following a suggestion already outlined in D2 associated with employing basic organic chemistry which has been even exemplified in similar in copolymers.

- 4.4 Summing up, the subject-matter of Claim 1 as granted is not based on an inventive step (Article 56 EPC).
5. Claim 1 as granted being not allowable, the appellant's main request (Claims as granted) has to be refused.

6. *Auxiliary requests I-IV*

6.1 A process feature has been introduced into Claim 1 of auxiliary request I (point V(a), above) to further characterize the functionalized syndiotactic styrene/p-alkylstyrene copolymers by the method of their preparation (product-by-process feature).

6.1.1 However, this amendment does not meet the requirements of Article 123(2) EPC because it has no proper support in the patent in suit (and the application as originally filed, respectively).

Firstly, the feature has no explicit counterpart in the patent in suit. Secondly, the patent in suit discloses a different level of generality for the preparation of the functionalized syndiotactic styrene/p-alkylstyrene copolymers than Claim 1 of auxiliary request I. Thus, paragraphs [0023]-[0032] of the patent in suit describe two different types of reactions for the preparation of the functionalized syndiotactic styrene/p-alkylstyrene copolymers, namely a direct reaction (eg bromination, metallation or carboxylation) and an "indirect" reaction where the functional group is introduced via the halogenated or metallated syndiotactic styrene/p-alkylstyrene copolymer which acts as an intermediate. The "indirect" method results in the attachment of, for example, -O-, -S-, -Si- or -N- to the benzylic position from which the metal or halide ion is displaced (nucleophilic substitution reaction). The amendment of Claim 1 of auxiliary request I subsumes these two different reaction patterns under one general reaction which does not require an intermediate step. Since, however, there is no support

- in the patent in suit that the introduction of O-, S-, Si- or N-based functional groups can be done without the intermediate step, the process feature in Claim 1 of auxiliary request I is directed to a different, unsupported level of generality than the patent in suit (or the application as originally filed, respectively).
- 6.1.2 However, even if the introduction of the process feature were considered to be allowable under Article 123(2) EPC, it is not suitable to overcome the inventive step objection raised in point 4.3, above. The amendment merely describes basic organic reactions which are considered to be obvious in view D2 and the common general knowledge and/or D3 and D4 anyway.
- 6.1.3 In view of the above, Claim 1 of auxiliary request I is not allowable.
- 6.2 Claim 1 of auxiliary request II (point V(b), above) further specifies the unfunctionalized styrene/p-alkylstyrene copolymer mentioned in the process feature by formula (II). Apart from the fact that this claim is even further away from the original disclosure (a formula (II) is not disclosed in the patent in suit and the application as originally filed, respectively), the objections raised against Claim 1 of auxiliary request I in view of Article 123(2) EPC (in point 6.1.1, above) and Article 56 EPC (point 6.1.2, above) equally apply to Claim 1 of auxiliary request II. Hence, Claim 1 of auxiliary request II is not allowable.
- 6.3 Claim 1 of auxiliary request III (point V(c), above) has been reformulated on the basis of the process feature of auxiliary request I and is now directed to a

method of preparing a functionalized styrene/p-alkylstyrene copolymer of formula (I) by subjecting an unfunctionalized styrene/p-alkylstyrene copolymer comprising benzylic protons to a functionalization reaction thereby partially substituting said benzylic protons with the functional group X. However, as explained in points 6.1.1 and 6.1.2, above, such a process is neither disclosed in the patent in suit and the application as originally filed, respectively (Article 123(2) EPC) nor is it suitable to overcome the inventive step objection (Article 56 EPC). Hence, Claim 1 of auxiliary request III is not allowable.

- 6.4 The same argumentation as for Claim 1 of auxiliary request III (point V(d), above) equally applies to Claim 1 of auxiliary request IV, because Claim 1 of the latter merely further specifies the unfunctionalized styrene/p-alkylstyrene copolymer by formula (II) (in this context see also point 6.2, above). Consequently, Claim 1 of auxiliary request IV is not allowable.
- 6.5 Summing up, Claims 1 of auxiliary requests I-IV are not allowable, and, consequently, auxiliary requests I-IV have to be refused.

7. *Auxiliary requests V-VII*

- 7.1 Claim 1 of auxiliary request V (point V(e), above) corresponds to Claim 1 as granted except that the definition for the functional group X is limited to a list of particular functional groups.

7.1.1 This limitation of X is based on granted Claims 3-6, 7 (partially) and 8-9. Thus, no objection under Article 123(2) and (3) EPC arises out of this amendment.

7.1.2 However, the amendment is not suitable to overcome the inventive step objection raised in point 4.3, above. Functionalized styrene/p-alkylstyrene copolymers having the restricted definition for X are still obvious from D2 in combination with common general knowledge and/or in combination with D3 and D4. Thus, D3 in particular mentions in column 8, lines 1-6 the conversion of the benzylic protons to various functional groups, such as -COOH, -OH, -NH₂, -Cl, -Br, -M, -COOM (M = metals, eg Li, Na, K and Ca). Faced with the problem of providing further functionalized syndiotactic copolymers, the person skilled in the art would make use of the versatility of the benzylic protons of the syndiotactic styrene/p-methylstyrene copolymers disclosed in the closest prior art to introduce further functional groups, and in particular those envisaged by the disclosure of D3 (in this context see also point 4.3, above). Thus, Claim 1 of auxiliary request V is not allowable in view of Article 56 EPC.

7.2 Claim 1 of auxiliary request VI (point V(f), above) is a combination of Claim 1 of auxiliary request V and the process feature of auxiliary request I. Such a combination cannot lead to an allowable claim because the introduction of the process feature does not meet the requirements of Article 123(2) EPC (point 6.1.1, above) and the subject-matter of such a claim would still not be based on an inventive step (points 4.3 and 7.1.2, above) even if the introduction of the process feature were considered to be allowable under

Article 123(2) EPC. Thus, Claim 1 of auxiliary request VI is not allowable.

7.3 Claim 1 of auxiliary request VII is identical with Claim 1 of auxiliary request VI. Thus, the objections raised in point 7.2, above, equally apply to Claim 1 of auxiliary request VII.

7.4 In view of the above, Claims 1 of auxiliary requests V to VII are not allowable, and, consequently, auxiliary requests V-VII have to be refused.

8. *Auxiliary request VIII*

8.1 In Claim 1 of auxiliary request VIII (point V(h), above), the functionalized syndiotactic styrene/p-alkylstyrene copolymer is restricted to a styrene/p-**methyl**styrene copolymer and X is restricted to -COOH, -OH, -NH₂, -M or -COOM with M being alkali or alkaline earth metal.

8.2 Firstly, Claim 1 of auxiliary request VIII is inconsistent in itself (Article 84 EPC). Although the claim has been restricted to a styrene/p-methylstyrene copolymer, R¹ and R² of formula (I) are still defined as being independently selected from the group consisting of hydrogen, alkyl, primary and secondary haloalkyl (in a styrene/p-methylstyrene copolymer both R¹ and R² have to be hydrogen!). Secondly, paragraph [0022] of the patent is not, as alleged by the appellant, a proper basis for the restriction of X. That paragraph refers to "M = metal, e.g. Li, Na, K and Ca" whereas Claim 1 refers to M in more general terms to "M being alkali or alkaline earth metal". Such a generalization is at

least questionable with respect to Article 123(2) EPC. Finally, both amendments are in principle not suitable to overcome the inventive step objections raised in points 4.3 and 7.1.2, above. A syndiotactic styrene/p-methylstyrene copolymer is actually the starting point for the assessment on inventive step and the definition of X overlaps to a great extent with the definition of the functional groups given in column 8 of D3: "... *functional groups, such as COOH, -OH, -NH₂, -C₁, -Br, -M, -COOM (M = metals, e.g. Li, Na, K and Ca) ...*".

8.3 Summing up, Claim 1 of auxiliary request VIII is not allowable, and, consequently, auxiliary request VIII has to be refused.

9. *Auxiliary requests IX-X*

9.1 The board was confronted at a very late stage in the oral proceedings with the filing of further auxiliary requests, namely auxiliary requests IX and X. According to the appellant, the necessity of further restricting the claimed subject-matter had become apparent during the oral proceedings, in particular because the board considered D2 as the closest prior art.

In line with T 577/97 of 5 April 2000 (not published in the OJ EPO), the board holds that it has at least the discretion to accept amended claims even at a late stage of the appeal proceedings. Of course, it has to be ascertained that the procedural fairness is not jeopardized by the admission of such late filed claims (T 360/01 of 21 October 2003; section 2.3 of the reasons; not published in the OJ EPO). Thus, the board

has to satisfy itself that the other party, although not present at the oral proceedings, could have properly dealt with the late filed claims.

In the present case, the amended claims are based on granted Claims 1 and 2 and are therefore simple and clear enough to be readily understood by the skilled person. Since, furthermore, the filing of auxiliary requests is the appellant's last chance to get its patent maintained, auxiliary requests IX and X were admitted into the proceedings for consideration.

9.2 Claim 1 of auxiliary request IX corresponds to Claim 1 as granted except that the functional group X has been restricted to X being metal. This restriction is a simple deletion of options which does not change the level of generality of the remaining option. Since, furthermore, Claim 1 of auxiliary request X corresponds to Claim 3 as granted, no objections under Article 123(2) and (3) EPC arise against the late-filed auxiliary requests.

9.3 However, the amendments are not suitable to overcome the inventive step objections raised in points 4.3 and 7.1.2. The list of possible functional groups in column 8 of D3 also refers to a functional group being -M, with M = metals, e.g. Li, Na, K and Ca (see point 8.2, above). Faced with the problem of providing further functionalized syndiotactic copolymers, the person skilled in the art would make use of the versatility of the benzylic protons of the syndiotactic styrene/p-methylstyrene copolymers disclosed in D2 to introduce further functional groups, and in particular those envisaged by the disclosure of D3. Since it has

not been demonstrated that a functional group being M, or alkali or alkaline earth metal is associated with any particular technical effect, nothing inventive can be seen in the selection of a functional group being M, alkali or alkaline earth metal out of a list of equally suitable functional groups.

The appellant's argument that the specific selection of the functional groups in Claims 1 of auxiliary requests IX and X allows the use of mild reaction conditions (paragraph [0022] of the patent in suit) or that the metallated syndiotactic styrene/p-alkylstyrene copolymers significantly broaden the scope of achievable functional groups (paragraph [0024] of the patent in suit) cannot alter the judgement on inventive step. Firstly, the mild reaction conditions referred to in paragraph [0022] are not particularly directed to metallation reactions but apply to reactions with the benzylic protons in general. Secondly, the person skilled in the art would be aware of the fact that a metallated carbon group can be used in electrophilic substitution reactions just as a halogenated carbon group can be used in nucleophilic substitution reactions. Thus, both arguments of the appellant cannot support inventive step.

- 9.4 In summary, Claims 1 of auxiliary requests IX and X do not meet the requirements of Article 56 EPC, and, consequently, auxiliary requests IX and X have to be refused.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

R. Young