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D E C I S I O N
of 1 June 2001

Case Number: T 0874/98 - 3.3.3

Application Number: 91202878.4

Publication Number: 0485035

IPC: C08G 67/02

Language of the proceedings: EN

Title of invention:

Process for the preparation of polymers

Applicant:

SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 123(2)

Keyword:

"Novelty (yes)"

"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



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Boards of Appeal

Chambres de recours

Case Number: T 0874/98 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 1 June 2001

Appellant:

SHELL INTERNATIONALE RESEARCH
MAATSCHAPPIJ B.V
Carel van Bylandtlaan 30
NL-2596 HR Den Haag (NL)

Representative:

-

Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 14 May 1998
refusing European patent application
No. 91 202 878.4 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: R. Young
Members: C. Idez
A. Lindqvist

Summary of Facts and Submissions

I. European patent application No. 91 202 878.4 was filed on 5 November 1991 in the name of Shell Internationale Research Maatschappij B.V., claiming priority of the earlier NL patent application 9002431 of 8 November 1990. The application was published under No. 0 485 035 on 13 May 1992.

II. At oral proceedings held on 13 January 1998, the Examining Division decided that the main request as well the first, the second and the third auxiliary requests submitted by the Applicant during the hearing were not allowable, but that the fourth auxiliary request related to patentable subject-matter. Consequently the Applicant was informed that the description would be brought into line with the fourth auxiliary request by the Primary Examiner and that a communication under Rule 51(4) EPC for said auxiliary request would be issued. The Examining Division also stated that, in case the Applicant would not be prepared to accept the grant of a patent on the basis of the fourth auxiliary request, the application would be refused according to Rule 51(5) EPC. Claim 1 of the fourth auxiliary request read, after correction of a minor error of punctuation, as follows:

"Process for the preparation of polymers, characterized in that linear polymers of carbon monoxide with one or more olefinically unsaturated compounds, in which polymers the units originating from carbon monoxide and the units originating from the olefinically unsaturated compounds occur in a substantially alternating order, are prepared by contacting the monomers at elevated temperature and pressure with a solution of a suitable

catalyst, in the presence of a liquid, non-polymerizable diluent at least consisting of one or more lower aliphatic alcohols and at least 2.5 % w of water, relative to the weight of the diluent."

Dependent Claims 2 to 7 referred to specific embodiments of the process according to Claim 1.

Independent Claim 8 read as follows:

"Use of water in the linear, substantially alternating copolymerization of carbon monoxide with one or more olefinically unsaturated compounds in the presence of a liquid, non polymerizable diluent at least consisting of one or more lower aliphatic alcohols to decrease the content of chemically bonded lower aliphatic alcohol in the copolymerization product."

- III. In its communication under Rule 51(4) EPC of 23 February 1998 the Examining Division informed the Applicant of its intention to grant a patent on the basis of Claims 1 to 8 of the fourth auxiliary request as submitted during the oral proceedings of 13 January 1998.
- IV. In response to the communication under Rule 51(4) EPC the Applicant indicated by his letter of 27 April 1998 that he did not approve the text on which the Examining Division had proposed the grant of the patent.
- V. On 14 May 1998 the Examining Division refused the application in accordance with Article 97(1) and Rule 51(5) EPC on the ground that there was no text to serve as a basis for the grant of a European patent (Article 113(2) EPC).

- VI. On 1 July 1998 an appeal was lodged by the Appellant (Applicant) against this decision with simultaneous payment of the prescribed fees.
- VII. The Statement of Grounds of Appeal was filed on 21 August 1998 and six sets of claims forming respectively a new main request and five auxiliary requests were annexed to this statement.
- VIII. In a communication issued on 14 December 2000, the Rapporteur raised objections under Article 123(2) EPC against Claim 1 of the first, the second and the third auxiliary request submitted with the Statement of Grounds of Appeal and indicated that the grant of a patent could be envisaged on the basis of Claims 1 to 7 of the fourth auxiliary request, provided an objection under Article 84 EPC concerning the wording "lower aliphatic alcohol" in Claim 1 of this request would have been overcome.
- IX. With his letter of 7 February 2001, the Appellant submitted a new set of claims to replace all sets of claims hence on file. This set of Claims 1 to 7 was based on Claims 1 to 7 of the fourth auxiliary request submitted with the Statement of Grounds of Appeal. Claim 1 reads as follows:

"Process for the preparation of polymers, characterized in that linear polymers of carbon monoxide with one or more olefinically unsaturated compounds, in which polymers the units originating from carbon monoxide and the units originating from the olefinically unsaturated compounds occur in a substantially alternating order, are prepared by contacting the monomers at elevated temperature and pressure with a solution of a suitable

catalyst, in the presence of a liquid, non-polymerizable diluent at least consisting of one or more of the alcohols selected from the group consisting of methanol, ethanol, 1- and 2-propanol, 1- butanol, 2-butanol, 2-methyl-2-propanol and corresponding diols, and at least 2.5 % w of water, relative to the weight of the diluent."

Dependent Claims 2 to 7 relate to specific embodiments of the process according to Claim 1.

- X. The Appellant requested that the decision of the Examining Division be set aside, and a patent be granted on the basis of Claims 1 to 7 submitted with letter of 7 February 2001. As an auxiliary request the Appellant requested oral proceedings.

Reasons for the Decision

1. The appeal is admissible.
2. *Admissibility of amendments*
 - 2.1 Claim 1 differs from Claim 1 as originally filed, by
 - (a) the deletion of the disclaimer "with the exclusion of the preparation of a CO/ethene/propene terpolymer at 56 bar and 85°C in the presence of a diluent consisting of 0.9% w toluene, 2.0% w water and 97,1% w methanol",
 - (b) the deletion of the wording "one or more lower aliphatic alcohols" and its replacement by "one or more alcohols selected from the group consisting

of methanol, ethanol, 1- and 2-propanol, 1-butanol, 2-butanol, 2-methyl-2-propanol and corresponding diols", and

(c) the indication that water is present in the diluent in an amount of at least 2,5% w, relative to the weight of the diluent.

2.1.1 Amendment (a) does not extend the subject-matter of the application beyond the content of the application as originally filed, since the indication in present Claim 1 that the water is present in an amount of at least 2,5% w automatically also excludes the process which was the subject of the disclaimer.

2.1.2 Amendment (b) is supported by lines 26 to 29 on page 3 of the description as originally filed, in which the meaning of the term "lower aliphatic alcohol" is defined.

2.1.3 There is also adequate support in the original application documents for amendment (c) (cf. Claim 3; page 3, lines 31 to 32).

2.2 Claims 2 to 7 correspond to Claims 2 and 4 to 8, respectively, as originally filed.

2.3 Thus, no objection arises under Article 123(2) EPC in respect of the amendments made, which are consequently admissible.

3. *Clarity*

The Board is satisfied that Claims 1 to 7 meet the requirements of Article 84 EPC.

4. *Documents*

The two documents which have been considered in the examining procedure can be summarized as follows.

4.1 D1 (EP-A-0 307 027) discloses a process for the preparation of polymers of carbon monoxide with one or more olefinically unsaturated compounds characterized in that carbon monoxide containing sulphur as sulphidic sulphur and/or iron carbonyls is subjected to one or more purifying treatments by which the sulphur and/or iron contents are decreased. The polymerization is carried out by contacting the monomers with a solution of a palladium-containing catalyst composition in a diluent such as methanol or ethanol. As indicated in D1 the presence of some impurities such as oxygen, water, hydrogen, carbon dioxide in very high concentrations in carbon monoxide have no adverse influence on average reaction rates. The aim of the process of D1 is to allow the use of impure carbon monoxide, and to remove only the impurities which have an extremely adverse effect on the average polymerization rates (i.e. iron carbonyls and sulphidic sulphur). In that respect Example 5 of D1 shows that the presence of approximately 2% w water in a diluent comprising methanol has no influence on the polymerization rate of a terpolymer of carbon monoxide, ethene and propene (cf. D1, column 1, lines 20 to 41; column 2, lines 32 to 43; column 3, lines 33 to 50; column 4, lines 28 to 43).

4.2 D2 (US-A-4 960 865) relates to a process for working up a linear alternating polymer of carbon monoxide and at least one ethylenically unsaturated hydrocarbon, which process comprises a) washing the polymer with water at

a temperature of between 80°C to 180°C in a liquid water to solid polymer ratio of between 0.5 to 10, b) separating the polymer from the water, and c) drying the polymer. The polymer is prepared by contacting the carbon monoxide and ethylenically unsaturated hydrocarbon in a ratio from 0,5 to 5 under polymerization conditions in the presence of a reaction diluent in which the polymer is substantially insoluble and a specific catalyst composition. Ethanol and methanol are mentioned as suitable diluents. The aim of the process of D2 is to provide polyketone polymers having a reduced amount of impurities and which can be used in the manufacture of containers for food and drinks (cf. D2, Claims 1, 5; column 4, line 60 to column 5, line 12; column 5, lines 24 to 47 and lines 59 to 67).

5. *Novelty*

Since neither D1 nor D2 discloses the use of a diluent at least consisting of one or more of the alcohols selected from the group consisting of methanol, ethanol, 1- and 2-propanol, 1-butanol, 2-butanol, 2-methyl-2-propanol and corresponding diols, and at least 2.5% w of water, relative to the weight of the diluent, in a copolymerization process of carbon monoxide with olefinically unsaturated hydrocarbons, the subject-matter of Claims 1 to 7 is considered as novel over D1 and D2 (Article 54(1)(2) EPC).

6. Closest prior art, technical problem and its solution.

6.1 As indicated in the present application a drawback of the use of aliphatic alcohols such as methanol in diluents for the copolymerization of carbon monoxide

with olefinically unsaturated compounds is that the obtained polymers contain 4000 to 15000 ppmw of the applied alcohol. This high alcohol content is a problem when the polymers are used in packaging applications for foodstuffs. Thus, the claimed process attempts to provide copolymers of carbon monoxide and olefinically unsaturated compounds having a reduced alcohol content which allow them to be used in packaging materials for foodstuffs.

6.2 D2, which is the only document concerned with the reduction of the impurity level in carbon monoxide/olefinically unsaturated copolymers and with the use of the copolymers in packaging applications for drinks and food, qualifies therefore as the closest prior art. In D2 the amount of impurities in the copolymers is lowered by submitting them to an extraction with hot water.

6.3 Thus, starting from D2, the problem underlying the present application may be seen in the definition of an alternative process for reducing the residual amount of the alcohol used in the diluent for the copolymerization in the obtained copolymers.

6.4 The solution proposed according to Claim 1 of the application in suit is to dispense with the hot water post-treatment, and instead to carry out the copolymerization of carbon monoxide with olefinically unsaturated compounds in the presence of a diluent at least consisting of one or more of the alcohols selected from the group consisting of methanol, ethanol, 1- and 2-propanol, 1-butanol, 2-butanol, 2-methyl-2-propanol and corresponding diols, and at least 2.5 % w of water, relative to the weight of the

diluent.

- 6.5 It is credible to the Board that the problem has effectively been solved, since the comparison between Example 1 (comparative) and Examples 4 and 5 of the present application clearly shows that the amount of residual alcohol in the obtained copolymers of Examples 4 and 5 has been drastically reduced.

7. *Obviousness*

It remains to be decided whether this solution can be considered as obvious to a person skilled in the art having regard to the teachings of D1 and D2.

- 7.1 There is no suggestion in D2 to incorporate water in the diluent in order to reduce the amount of residual alcohol in the obtained copolymers, since D2 only refers to a post polymerization treatment of the copolymers (hot water extraction) for lowering their impurity level. Consequently, there is no hint to the solution of the technical problem in D2 itself.
- 7.2 Although D1 discloses that water may be present in the diluent due to introduction by impure carbon monoxide, this document only states that water has no adverse effect on the average polymerization and does not contain any information concerning the influence of the water content of the diluent on the amount of residual alcohol in the obtained copolymers. This disclosure has no apparent relevance to the technical problem and the skilled person would have no incentive to apply its disclosure for such a purpose, let alone further to increase the level of water impurity into the relevant range.

7.3 In summary, the solution of the technical problem does not arise in an obvious way from the cited state of the art. Consequently, the subject-matter of Claims 1 to 7 involves an inventive step within the meaning of Article 56 EPC.

8. In view of the above the main request is allowable. Since the main request is allowable, there is no need to hold oral proceedings.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent on the basis of Claims 1 to 7 of the main request submitted with letter of 7 February 2001 and after any necessary consequential amendment of the description.

The Registrar:

The Chairman:

E. Görgmaier

R. Young