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**Datasheet for the decision
of 7 February 2020**

Case Number: T 2368/16 - 3.3.06

Application Number: 14753318.6

Publication Number: 2838656

IPC: B01J31/18, C08J11/28, B01J31/16

Language of the proceedings: EN

Title of invention:
POLYMER DEGRADATION

Applicant:
Ioniqa Technologies B.V.

Headword:
Ionic liquid supported catalyst/IONIQA

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

Keyword:
Sufficiency of disclosure - (yes)
Amendments - multiple selections from lists of converging
alternatives - allowable (yes)

Decisions cited:
T 1621/16

Catchword:



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Case Number: T 2368/16 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 7 February 2020

Appellant: Ioniqa Technologies B.V.
(Applicant) De Lismortel 31
5612 AR Eindhoven (NL)

Representative: Nollen, Maarten Dirk-Johan
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 26 January 2016
refusing European patent application No.
14753318.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman J.-M. Schwaller
Members: S. Arrojo
J. Hoppe

Summary of Facts and Submissions

I. The present appeal lies from the decision of the examining division to refuse European patent application No. 14 753 318.6 for non-compliance with the requirements of Article 83 EPC.

II. With its grounds of appeal the applicant (hereinafter "the appellant") contested the decision inter alia on the basis of the following documents cited in the application as filed:

E1: Valkenberg et al, "*Immobilization of ionic liquids on solid supports*", *Green Chemistry*, 2002(4), pages 88-93

E2: Lee, "*Functionalized imidazolium salts for task-specific ionic liquids and their application*", *Chem. Commun.* 2006, 1049-1063

E3: M. Freemantle, *An Introduction to Ionic Liquids* (RSC, Cambridge UK: 2010), pages 1 to 11, 19 to 30 and 108 to 110.

Further, it filed auxiliary requests I to X (including IIA, IIB and IIC).

III. The board issued a communication with its preliminary opinion that the main request and auxiliary requests I to IX (including IIA, IIB and IIC) should not be admitted into the proceedings under Article 12(4) RPBA and that auxiliary request X did not meet the requirements of Article 83 EPC.

- IV. In reply the appellant filed new auxiliary requests XI to XIV with letter of 7 October 2019.
- V. With letters dated 30 and 31 January 2020 it then filed two new requests, with claim 1 of the latest main request reading as follows:

"1. Method of degrading a homo or copolymer into oligomers, trimers, dimers and/or monomers, comprising the steps of

providing the polymer in a suitable solvent, wherein the polymer is one or more of a polyester and a polyether, wherein the solvent is capable of reacting with the polymer being degraded, and chosen from an alkanol or alkanediol, water and amino comprising reactants, the polymer being in solid form,

adjusting temperature and pressure to reaction conditions, wherein the degrading is performed at a temperature of 150°C-250°C during a period of 0.1 minutes-168 hours, wherein the pressure is from 90kPa-10.000kPa,

providing a catalyst complex comprising a catalyst entity, a magnetic nanoparticle, and a bridging moiety solely between the catalyst entity and the magnetic nanoparticle, wherein the bridging moiety is attached, such as by a covalent bond, to the nanoparticle and the catalyst entity is chemically attached to the bridging moiety, the catalyst complex being capable of degrading a polyester or polyether polymer into oligomers, trimers, dimers and/or monomers, wherein the catalyst entity comprises a first and a second moiety, wherein the first is an aromatic moiety having a positive charge and the second is a moiety having a negative charge,

wherein the positive charge is on an aromatic 5-membered heterocycle having at least two nitrogen atoms, which is an imidazole, and

wherein the negative charge is on a Fe³⁺ salt complex moiety having a three-plus charged iron ion and negatively charged counter-ions, such as an halogenide, wherein the magnetic particles have an average diameter of 3 nm-100 nm,

wherein the magnetic particles are one of ferrite, magnetite, hematite and maghemite,

wherein the bridging moiety is one or more of a weak organic acid, silanol, silyl comprising groups, and silanol, and

*wherein the bridging moiety is present in an amount of 5*10⁻⁶-0.1 Mole bridging moiety/gr magnetic particle, wherein the amount of catalyst is 0.1-35 wt.%, relative to a total weight of polymer provided, wherein the amount of catalyst relates to the catalyst entity and bridging moiety without nanoparticle;*

degrading the polymer over a period sufficient to degrade a significant portion thereof,

recovering the catalyst complex, and

recycling the recovered catalyst complex."

VI. The appellant requested to grant a patent on the basis of the claims of this new main request, as filed with letter dated 31 January 2020 or, auxiliarily, on the basis of one of auxiliary requests I to X (including IIA, IIB and IIC), filed with the grounds of appeal, or of one of auxiliary requests XI to XIV, filed with letter dated 7 October 2019.

Reasons for the Decision

1. Main request - Article 83 EPC
 - 1.1 The Board has concluded that the main request meets the requirements of Article 83 EPC.
 - 1.2 In its decision, the examining division argued that the invention was not sufficiently disclosed because not enough information was provided on how the complex catalyst should be prepared and on how to verify if it had the requested features. In essence the arguments of the examining division were as follows:
 - the catalyst complex was simply defined in terms of its fragments without properly explaining how these should be bound to each other;
 - the documents cited would not be consulted for learning how to carry out the invention because they were simply described for the purpose of establishing the disadvantages of using ionic liquid catalysts immobilised on solid supports as catalysts;
 - if the methods of the prior art were taken into account, they could not even be applied to the most specific embodiment of the invention (i.e. butyl methyl imidazolium and FeCl_4^- with triethoxysilylpropyl as bridging moiety on a magnetite and or maghemite nanoparticle as described in page 15, lines 5-15), because the fragments were different from those used in the cited prior art and the substituted imidazolium would not bind to the silyl or to the nanoparticle;

- the binding of the fragments to each other did also not appear to be evident in view of the following passages of the application:

"... it is somehow complicated to combine (or coat) the present nanoparticle with a bridging moiety, at least in terms of functionality obtained. It is not only important to provide suitable bridging moieties (or a combination thereof), but also to fit a number of bridging moieties with respect to a surface area of the present magnetic nanoparticle. In this respect also a size (diameter) of the present nanoparticle is important." (page 6, line 36 ff);

"a proper functionalized magnetic particle is important" (page 7, lines 13-14);

"... it is not possible to just choose a magnetic metal and/or counter-ion at random; present inventors have found that some sophisticated tailoring is required." (page 9, line 37 ff.).

1.3 In view of the amendments to the subject-matter of claim 1 and the arguments brought forward by the appellant, the board considers that the claimed invention is sufficiently disclosed under Article 83 EPC for the following reasons:

1.3.1 The restriction of claim 1 to a catalyst entity formed by a positively charged imidazole (i.e. an imidazolium) and a negatively charged complex salt clearly indicates that the invention concerns a catalyst complex formed by an ionic liquid supported on nanoparticles. In this respect, the board considers that the person skilled in the art **would be familiar with the content of document E3**, a handbook relating to ionic liquids, which also deals with the use of supported ionic liquids as catalysts.

1.3.2 Furthermore, while it is true, as the examining division argued, that the catalysts in documents E1 and E2 (dealing with supported ionic liquid catalysts) are described in the application as generally delivering poor selectivity and conversion rates, these disadvantages are presented simply as a way to argue that such complex catalysts would in principle not be considered for the purpose of improving selectivity or conversion rates. This is however an introductory remark, which is followed by the "*surprising*" findings of the inventors, according to which these catalyst complexes provide improvements in terms of selectivity and conversion rates when used for the purpose of degrading certain polymers (see page 4, line 26 - page 5, line 11 of the published application). The board is therefore of the opinion that the skilled reader would also **consult the information in E1 and E2** for the purpose of preparing the catalyst complex of the invention.

1.3.3 In view of scheme 3 of E1 (page 90), scheme 6 of E2 (page 1055) and figure 8.1 of E3 (page 109), it is apparent that the bridging moiety should be added to the imidazolium cation prior to its binding to the nanoparticles. It is well known that in order to add groups to different positions of organic molecules, those positions need to be previously functionalised with reactive groups such as halogens. In this respect, the handbook E3 indicates in page 25 that "Typically, functionalized halogenoalkanes are used to prepare ionic liquids with functionalized imidazolium".

From this starting point and in view of the information in E1, E2 and E3, the skilled person would find no major difficulties in binding the bridging moieties defined in claim 1 to an imidazolium with a reactive

group, or in subsequently binding the resulting molecule to the surface of the iron oxide nanoparticles.

1.3.4 Since the current set of claims does not define an invention having a catalyst complex comprising butyl methyl imidazolium/ FeCl_4^- (as catalyst entity) and triethoxysilylpropyl (as bridging moiety), the alleged technical difficulties to chemically bind these substances do no longer prejudice the reproducibility of the invention under Article 83 EPC.

1.3.5 Concerning the passages of the application which allegedly acknowledge technical barriers to carry out the invention, the following is noted:

- To overcome the difficulties to bind the bridging moiety to the nanoparticles (page 6, lines 36-39 of the description as filed) the invention in claim 1 specifies the bridging moieties, the amount of bridging moieties per unit weight of the magnetic nanoparticles and the size of the nanoparticles, which the description itself (page 6, line 39 - page 7, line 7) identifies as the key features to overcome these barriers;
- To overcome the additional problems mentioned in page 7, lines 13-14 and page 9, line 37 ff of the description as filed, the invention in claim 1 is restricted to specific magnetic nanoparticles and counter-ions.

1.4 The board is therefore of the opinion that the application provides enough information to carry out the invention as defined in the claims.

2. Main request - Article 123(2) EPC
- 2.1 The board has concluded that the main request complies with the requirements of Article 123(2) EPC.
- 2.2 The subject-matter of claim 1 is based on a combination of originally filed method **claims 7, 9, 10 and 11** with the originally filed catalyst complex **claims 1, 3 and 6**, wherein the recycling step has been added from an exemplary embodiment disclosed in page 14, lines 16-17 of the original description, and wherein the original wording of the claims has been further amended as follows:
 - 2.2.1 Claim 9 as originally filed: the most preferred polymers (*"one or more of a polyester and a polyether"*) according to page 12, lines 1-3 of the description as filed have been selected;
 - 2.2.2 Claim 10 as originally filed: the optional feature *"preferably forming a mono- or di-ester with the monomer"* has been omitted;
 - 2.2.3 Claim 11 as originally filed: the broadest reaction time range has been selected, the temperature range has been restricted to a more preferred range (see basis for this restriction in page 12, lines 25-28 of the description as filed), and the ranges for the pressure and the amount of catalyst correspond to the broadest alternatives;
 - 2.2.4 Claim 3 as originally filed: the optional examples for the bridging moieties have been omitted;
 - 2.2.5 Claim 6 as originally filed: the aromatic moiety has been restricted to the preferred option of *"imidazole"*

(note that imidazole is a specific type of *"5-membered heterocycle having at least two nitrogen atoms"*) and the diameter of the magnetic nanoparticles corresponds to the broadest alternative.

2.3 It is further noted that the original claim structure explicitly supports amending the method claims in view of the catalyst complex in claim 1-6, i.e. the method claim 7 includes a step of *"providing a catalyst complex"* and optionally refers back to *"recovering the catalyst complex, such as the catalyst complex of claims 1-6"*, which clearly implies that in the original application the catalyst complex provided in this method is (optionally) that defined in claims 1-6.

2.4 The amendments to the original wording of the claims involve the selection of more preferred or less preferred options from lists of converging alternatives (i.e. lists of options ranked from the least to the most preferred, wherein each of the more preferred alternatives is fully encompassed by all the less preferred and broader options in the list). In particular, the above indicated restrictions of the features in claims 6 and 11 as originally filed are based on selecting elements from lists of converging alternatives.

According to **T 1621/16** (Catchword), selections from lists of converging alternatives should not be treated as arbitrary selections, and amendments based on multiple such selections are allowable under Article 123(2) EPC as long as the combination resulting from this multiple selection is supported by pointers in the application as filed and is not associated with an undisclosed technical contribution.

- 2.5 In the present case, all the features which have been restricted by selecting elements from lists of converging alternatives were part of the original set of claims. Since the claims are generally regarded as preferred fall-back positions, it is considered that the set of claims as originally filed provides a pointer to the combination of features defined in claim 1. Furthermore, there is no indication that the combination of features in amended claim 1 is associated with an undisclosed technical contribution.
- 2.6 The board therefore concludes that the subject-matter of claim 1 is allowable under Article 123(2) EPC.
3. With regard to the foregoing conclusions, the reasons that led to the refusal of the application do not longer apply to the subject-matter as claimed with the new main request. Furthermore at least the issues of novelty and inventive step are not addressed in the contested decision. Under these particular circumstances the board exercises its discretion to remit the case to the examining division for further prosecution (Article 111(1) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the examining division for further prosecution.

The Registrar:

The Chairman:



A. Pinna

J.-M. Schwaller

Decision electronically authenticated