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**D E C I S I O N**  
**of 2 February 1998**

**Case Number:** T 0013/96 - 3.4.2

**Application Number:** 89830020.7

**Publication Number:** 0325567

**IPC:** H01M 4/92, B01J 23/42, B01J 35/10

**Language of the proceedings:** EN

**Title of invention:**  
Process for preparing an electrocatalyst

**Patentee:**  
Tanaka Kikinzoku Kogyo K. K., et al

**Opponent:**  
Degussa AG, Frankfurt - Zweigniederlassung Wolfgang-

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 100(b)

**Keyword:**  
"Insufficiency of disclosure (yes)"

**Decisions cited:**  
T 0292/85, T 0060/89, T 0226/85

**Catchword:**  
-



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Boards of Appeal

Chambres de recours

Case Number: T 0013/96 - 3.4.2

**D E C I S I O N**  
of the Technical Board of Appeal 3.4.2  
of 2 February 1998

**Appellant:**  
(Proprietor of the patent)

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**Respondent:**  
(Opponent)

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**Representative:**

-

**Decision under appeal:**

Decision of the Opposition Division of the  
European Patent Office posted 16 November 1995  
revoking European patent No. 0 325 567 pursuant  
to Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** E. Turrini  
**Members:** R. Zottmann  
V. Di Cerbo

## Summary of Facts and Submissions

- I. The Appellant (Patentee) lodged an appeal against the decision of the Opposition Division revoking the patent No. 0 325 567 with the application No. 89 830 020.7.

The opposition was based on paragraphs (a), (b) and (c) of Article 100 EPC.

The Division held that, though claim 1 met the requirements of Article 100(c) and was novel, the ground for opposition mentioned in Article 100(b) (insufficiency of the patent disclosure) prejudiced the maintenance of the patent, in particular since a detailed example or adequate instructions in the specifications concerning the colloid particles and process features are missing and the average distance of the catalyst particles is an unusual parameter in the field of catalysts.

In a chapter "Additional Remarks" following the grounds for the decision, the Division set forth that an inventive step over the prior art cannot be recognized for the subject-matter of claim 1.

- II. The following document will be cited in this appeal decision:

D6: Electrochimica Acta, 23 (1978), 6, pp. 489 to 492.

- III. Claims 1 and 2 read as follows:

"1. A process of preparing an electrocatalyst comprising an electroconductive carbon support and active catalyst metal particles supported thereon, which comprises applying to said carbon support having a known specific surface area an active metal catalyst

in the form of preformed colloidal particles having a known average diameter and a known density while ensuring a resulting average interparticle distance of the catalyst metal particles on the support comprised between 15 nm and 27 nm.

2. A process as defined in claim 1, wherein said resulting average interparticle distance is determined by applying a percent by weight of said active metal catalyst on said carbon support as derived from the following equation

$$x = \sqrt{\pi \sigma d^3 S_c (100 - y) / 3\sqrt{3} y} \text{ (nm)}$$

where

$\sigma$ : density of said active metal catalyst particles  
(unit:g/nm<sup>3</sup>)

$d$ : average diameter of the catalyst metal particles  
(unit:nm)

$S_c$ : specific surface area of said carbon support  
(unit:nm<sup>2</sup>/g)

$y$ : percent by weight of supported active metal catalyst on said carbon support."

Claims 3 and 4 are dependent on claim 1.

IV. The Appellant requested that the decision under appeal be favourably reconsidered and reversed, but did not request oral proceedings.

The Respondent (Opponent) requested that the appeal be rejected and oral proceedings be held unless the appeal is rejected.

- V. The Appellant's arguing with regard to sufficiency of the patent is summarized as follows:

The formula proposed by the inventors provides the necessary correlation among the pertinent geometrical parameters of the catalyst that will produce the desired average interparticle distance  $x$ . In the context of the process of the invention it is truly cosmetics to propose an individual range for the different parameters which may vary in broad ranges, depending on the metal that is being reduced into a colloidal suspension and on other parameters of the solution. Any skilled technician has analytical means and expertise for assessing these parameters. With the aid of said formula he will be able to make the appropriate choices and adjustments that will ensure the desired  $x$ . The preformed colloidal particles of the metal catalyst "coat" the support particles and, upon drying of the supported catalyst, the catalyst particles will reproduce substantially the "original" closest packing distribution of the precursor colloidal particles. In the result, the disclosure meets the standard established in decisions T 226/85, T 292/85 and T 60/89.

- VI. The Respondent's arguing with regard to sufficiency of the patent disclosure is summarized as follows:

None of the arguments of the Appellant adds new facts to overcome the objections of the Opposition Division. The patent does not disclose the process parameters needed to obtain catalysts with the desired  $x$  of claim 1. The proposed formula of claim 2 is a mere mathematical derivation of  $x$  under the assumption of the most even distribution pattern in a hexagonal

arrangement on a plane (said formula is derived in the annex to the Respondent's letter dated 19 July 1996). Such a theoretical calculation of x does not ensure to achieve the desired x in practice.

### Reasons for the Decision

1. The appeal is admissible.
2. *Added subject-matter with regard to claim 1 (Article 100(c) EPC)*

The Board sees no reason to deviate from the opinion of the Opposition Division that claim 1 does not contain subject-matter which extends beyond the application as originally filed. Since the Respondent did not address this point during the appeal proceedings, it is not necessary to give detailed reasons for this finding.

3. *Sufficiency of disclosure (Article 100(b) EPC)*
  - 3.1 An attack on the ground of insufficiency of the patent under Article 100(b) EPC is, of course, based on Article 83 EPC, which requires that the disclosure of the invention must be "sufficiently clear and complete for it to be carried out by the person skilled in the art".

In the following decisions cited by the Appellant, the boards of appeal have established standards for the assessment of said requirement: In decision T 226/85 (OJ EPO 1988, pages 336 to 341; see particularly section 8.), the Board stated that, even though a reasonable amount of trial and error is permissible when it comes to the sufficiency of disclosure, there must then be available adequate instructions in the

specification or on the basis of common general knowledge which would lead the skilled person necessarily and directly towards success through the evaluation of failures or through an acceptable statistical expectation rate in case of random experiment. In decisions T 292/85 (EPO OJ 1989, pages 275 to 296; see particularly section 3.1.5) and T 60/89 (EPO OJ 1992, pages 268 to 283, see particularly section 2.2.2) the Boards ruled that an invention is sufficiently disclosed in the meaning of Article 83 EPC if at least one (reproducible) way is clearly indicated enabling the skilled person to carry out the invention.

- 3.2 The wording of claim 1 of the attacked patent contains only one concrete process step (a), namely applying preformed colloidal particles on a carbon support (the phrase "[colloidal particles] having a known average diameter and a known density" does not define an ascertainable technical feature). Feature (a) is further determined only by a result (a1) to be obtained: "while ensuring a resulting average interparticle distance of the catalyst metal particles on the support comprised between 15 nm and 27 nm" (said interparticle distance is hereinafter called "distance x" or "x") . It is thus unclear from claim 1 by which process conditions and material properties etc. said result (a1) should be achieved.

Moreover, the distance x is an unusual quantity in the field of electrocatalysts which is confirmed by the fact that none of the prior art documents on file describes such a quantity or a process for manufacturing an electrocatalyst having a certain value of this quantity, and the calculation of x on the basis of the formula of the patent specification is considered as being inadequate (see 3.4 below).

3.3 The patent specification contains one example directed to the preparation of platinum catalysts having a platinum loading of 10 wt%. However, the example does not indicate the specific surface of the support particles (only the very broad and thus insignificant range - 60 to 1400 m<sup>2</sup>/g - and the range of particle diameter - 10 to 50 nm - are indicated), the amount/concentration, size and kind of the colloid or, respectively, the dispersing phase; the specific parameters of the catalyst and support particles (e.g. d, Sc and y of the formula of claim 2) and further process step details concerning the preparation of the colloid, mixing/deposition, separation, drying/heating/calcination, agent addition etc. being necessary for carrying out the claimed process of preparing an electrocatalyst having the x range of claim 1.

The Appellant, not even in his submissions, has put forward such a detailed example to corroborate his allegations (see section V above) that the skilled person was able at the application date to make the appropriate choices and adjustments to manufacture an electrocatalyst with the desired properties.

3.4 Furthermore, instructions concerning the above features are not derivable from the other parts of the specification including document D6 cited in the application as originally filed. The latter document is not concerned with colloidal catalyst particles and does not mention the average interparticle distance x of the catalyst metal particles or a similar quantity.

3.5 The Appellant argues (see section V above) that the proposed formula for x provides the correlation between the parameters of the catalyst and support particles that will produce the desired x. Supposing that the skilled person was able to determine or assess said



parameters and that the formula is adequate, he would only be able to calculate a theoretical average interparticle distance and to decide whether this parameter  $x$  of a manufactured catalyst lies - accidentally - within the indicated range or not. But he gets no information which process parameters lead the skilled person necessarily and directly to an electrocatalyst having the desired  $x$  and an elevated mass activity of the catalyst metal aimed at by the patent in suit.

Moreover, said formula is a mathematical derivation of  $x$  assuming that the colloid particles are regularly arranged in the closest (hexagonal) packing on a plane support surface (see the annex to the Respondent's letter dated 19 July 1996). However, the support particles have a diameter of 10 to 50 nm and have usually a rough surface, whereas the dimension and thus the distance of the colloid particles lies in the same order, namely between 15 and 27 nm. Therefore, neither the assumption that the surfaces of the support (particles) are (at least essentially) plane, nor the assumption that the diameters of the colloid particles are considerably lower than the dimensions of the support particles are fulfilled. Thus, the formula of claim 2 and the description do not correctly define the real average interparticle distance of the catalyst metal particles mentioned in claim 1.

- 3.6 To summarize, in the absence of any detailed example and of available instructions in the specification or in the prior art cited in the specification which would lead the skilled person unambiguously towards success, the Board of Appeal comes to the conclusion that the ground for opposition mentioned in Article 100(b) prejudices the maintenance of the patent.

4. *Novelty and inventive step (Article 100(a) EPC)*

The question of novelty or inventive step of the subject-matter of claim 1 has become irrelevant in view of the above findings and the Board of Appeal need not deal with it.

5. A decision can now be taken due to the fact that the Appellant did not request oral proceedings and that said decision is based on grounds on which the parties concerned have had an opportunity to present their comments (Article 113(1) EPC).

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

P. Martorana

E. Turrini