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Datasheet for the decision of 5 August 2008

Case Number: T 0128/05 - 3.3.05

Application Number: 96117077.6

Publication Number: 0766330

IPC: H01M 8/12

Language of the proceedings: EN

Title of invention:
Components for use in electrochemical cells and their use in oxygen separation

Patentee:
THE STANDARD OIL COMPANY

Opponent:
AIR PRODUCTS AND CHEMICALS, INC.

Headword:
Element for electrochemical cell/STANDARD OIL

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step (no) - obvious further device"

Decisions cited:
-

Catchword:
-

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Case Number: T 0128/05 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 5 August 2008

Appellant: (Patent Proprietor)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 26 November 2004 revoking European patent No. 0766330 pursuant to Article 102(1) EPC 1973.

Composition of the Board:

Chairman: G. Raths
Members: B. Czech
S. Hoffmann

Summary of Facts and Submissions

I. The appeal is from the decision of the opposition division revoking European patent No. 0 766 330.

II. The opposition was inter alia based on the grounds of lack of novelty and lack of inventive step. More particularly, the opponent raised several novelty objections in view of various prior art documents, including the following:

D15: Hidenori Yahiro et al., "High Temperature Fuel Cell with Ceria-Yttria Solid Electrolyte"; J. Electrochem. Soc., Vol. 135, No. 8, 1988, pages 2077 - 2080

D3: O. Yamamoto et al., "Perovskite-type oxides as oxygen electrodes for high temperature oxide fuel cells"; Solid State Ionics, Vol. 22, 1987, pages 241 - 246.

III. The contested decision is based on a set of amended claims 1 to 8 filed during the oral proceedings on 10 November 2004 (see Minutes, point 4.4, and Annex 1 to the contested decision). Claim 1 according to this request has the following wording (additions to claim 1 as granted highlighted by the board):

"*1. An element for use in an electrochemical cell having a first surface capable of reducing oxygen to oxygen ions, a second surface, an electron-conductive path between the first and second surfaces and an oxygen ion-conductive path between the first and second surfaces characterised in that the element comprises*

(A) solid multi component membrane characterised by (1) a solid electrolyte, (2) an intimate, gas impervious, multi-phase mixture of an electronically-conductive phase and an oxygen ion-conductive phase or (3) a mixed metal oxide material having a perovskite structure and (B) a conductive coating, ***and*** *a catalyst, or a conductive coating comprising a catalyst, said catalyst* ***and said coating*** *being associated with at least said first surface, comprises at least one member of the group consisting of* La_2O_3*, oxides of lanthanum doped with europium, oxides of a mixture of lanthanum, strontium and cobalt, oxides of a mixture of zinc and iron, oxides of molybdenum and oxides of tungsten.*"

The opposition division came to the conclusion that the claims as amended met the requirements of Article 123(2), respectively 76(1) EPC, but that the subject-matter of the said claim 1 lacked novelty over document D15 which disclosed a solid electrolyte fuel cell with a $La_{0.6}Sr_{0.4}CoO_3$ cathode.

IV. In its statement of grounds of appeal, the appellant (proprietor of the patent) disagreed with the reasons given by the opposition division and argued that claim 1 as amended was novel over D15.

V. In its reply of 26 July 2005, the respondent (opponent) inter alia maintained that the subject-matter of amended claim 1 underlying the contested decision lacked novelty over D15, but also over a number of other prior art documents including D3. In a further letter of 4 July 2008, the respondent additionally raised objections under Articles 123(2) and (3) EPC concerning the amendments to claim 1 and also

questioned the clarity of the said amended claim 1 under Article 84 EPC. Moreover, it additionally argued that the claimed subject-matter was at least not based on an inventive step, inter alia in view of a combination of D15 with D3.

VI. Oral proceedings took place on 5 August 2008 in the absence of the appellant, who had previously indicated by telefax of 24 June 2008 that it would not attend.

VII. The arguments of the appellant as put forward in its statement of grounds of appeal read as follows:

"The opposition division based their argument on document Dl5 stating that the cathode (d) in Figure 6 acted as both a conductive coating and a catalyst associated with the first surface. The patentee disagrees. Electrode (d) cannot be regarded as a coating. The common understanding of the wording coating would be a thin layer of material that covers a substantial part of the coated article. Electrode (d) does not cover a substantial part, in fact it would cover significantly less than 50%. Furthermore a coating does not have an integrity separate from the coated article. This is illustrated in Dl5 where it is stated that a "thin film of stabilised zirconia was coated on the surface (of) ceria yttria disk (fig.6b) by RF sputtering"; the coating (a) can be clearly seen in Figure 6 (and has a thickness below 1 μm). On the other hand it is stated that "After coating, a Pt electrode (Fig.6d) was applied". This indicates clearly that the electrode had an integrity that was separate from the disk. It must be the case for the cathode also. Consequently it is the patentee's assertion that

electrode (d) cannot be regarded as a conductive coating and claim 1 as amended is novel in the light of Dl5".

VIII. The relevant arguments of the respondent can be summarised as follows:

The amendments to claim 1 as granted (highlighted under point III above) were objectionable under Articles 123(2)(3) EPC since the amended claim referred to embodiments with a conductive coating made of materials only disclosed in the application as filed as materials for the catalyst. Moreover, claim 1 as amended was grammatically incorrect and consequently unclear.

D15 disclosed all the features of that alternative in claim 1 according to which a solid electrolyte was - at least implicitly - coated with a conductive and catalytic oxide of lanthanum, strontium and cobalt. The appellant argued inter alia that "to exploit the entire area of the solid electrolyte electrons need thus to be provided all over this surface, such that the electrode must extend on the entirety thereof" and that "an electrode for a skilled worker will thus cover the majority of the surface of the electrolyte". In case the subject-matter of claim 1 was considered to be novel over D15, then at least it lacked inventive step in view of inter alia D15 in combination with common general knowledge or D3. D3 disclosed the deposition of a $La_{1-x}Sr_xMO_3$ cathode material onto the YSZ electrolyte by sputtering, i.e. in form of a "*coating*" in the sense of present claim 1.

IX. The appellant has not expressis verbis made any request.

The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. *Procedural matters*

The impugned decision is based on a specific set of claims submitted as sole and final request during the oral proceedings before the opposition division. Although the appellant did not expressis verbis make any request in the appeal proceedings, it is implicit in the notice of appeal that the appellant aims at the cancellation of the decision of the opposition division. The board thus concludes that the appeal is admissible and that the appellant has implicitly requested that the contested decision be set aside and that the patent be maintained on the basis of the claims underlying the contested decision, i.e. claims 1 to 8 filed during the oral proceedings of 10 November 2004 before the opposition division. This was not disputed by the respondent.

2. *Amendments*

2.1 Present claim 1 as amended is directed to several distinct alternatives (distinguished by the use of the word "*or*") as far as components (A) and (B) are concerned. According to one of these alternatives, component "*(A)*" may be "*(1) a solid electrolyte*" and component "*(B)*" may be a "*conductive coating comprising a catalyst*". Moreover, according to present dependent

claim 4, the "*catalyst*" may be "*an electrically conductive coating*". The said coating may thus be made of a single material which is both electrically conductive and catalytic. The present decision concerns this particular alternative of claim 1.

2.2 The objections raised by the respondent under Articles 123(2)(3) and 84 EPC against the amendments to claim 1 merely concern claimed alternatives differing from the one identified under point 2.1 above in that the conductive coating and the catalyst are distinct structural entities. The said objections have no bearing on the board's finding concerning the lack of inventive step (see point 4 below) of the particular alternative identified under point 2.1, wherein the coating is made from a material which is both electrically conductive and a catalyst. Therefore, said objections need not be dealt with in this decision since they are without prejudice to the reasons for which the appeal fails.

3. *Novelty over document D15*

3.1 Document D15 relating to high temperature fuel cells reports the results of investigations concerning the behaviour of various cathode materials in fuel cells comprising a ceria-yttria solid electrolyte arranged between two electrodes. Oxygen is being reduced at the first surface (cathode side) of the arrangement, whereas hydrogen is oxidised at the opposite surface. The solid electrolyte provides an oxygen ion-conductive path between the electrodes, and an (outer) electron-conductive path between the electrodes is formed by the external circuitry necessary for the reported

measurements of the power density obtained upon operation of the fuel cell. A schematic view of the fuel cells tested is shown in Figure 6. Although the caption of Figure 6 refers to electrodes "d" made of platinum, it is explained in the text part of D15 that the cathode materials investigated also included perovskite-type oxides. $La_{0.6}Sr_{0.4}CoO_3$ is disclosed as a preferred perovskite-type cathode material. Table I of D15 lists the fuel cell performance data obtained when varying the cathode materials, including $La_{0.6}Sr_{0.4}CoO_3$. Reference is made in particular to D15, the "ABSTRACT", page 2079, left-hand column, Section "3. Cathode materials…", Table I, and "Conclusion".

The preferred cathode material of D15, i.e. $La_{0.6}Sr_{0.4}CoO_3$, is a material which is electrically conducting and has catalytic properties. This was not disputed by the appellant and is also acknowledged in the patent in suit (see e.g. sections [0044], [0049] and page 13, line 53). D15 thus undisputedly also discloses the following features of the alternative of claim 1 referred to in point 2.1 herein above: an "*element for use in an electrochemical cell comprising (A) solid multi component membrane characterised by (1) as solid electrolyte*" and as component "*(B)*"a (cathode) made of a material ($La_{0.6}Sr_{0.4}CoO_3$) which is both "*conductive*" and "*comprising a catalyst*", the material being "*associated with at least said first surface and belonging to the group consisting of …, oxides of a mixture of lanthanum, strontium and cobalt …*".

3.2 However, the parties did not agree on whether or not D15 disclosed cathodes in the form of a coating in the sense of feature "*(B) a conductive coating*" in present

claim 1. In this connection the board notes that according to the indications in D15, page 2079, left-hand column, section "4. Coating of …", the platinum electrode "d" referred to in Figure 6 was "applied and fired" (emphasis added by the board). D15 contains no explicit information on how the $La_{0.6}Sr_{0.4}CoO_3$ cathodes tested were actually "applied".

3.2.1 Whereas the appellant argued that the cathodes disclosed in D15 were not coatings in the sense of claim 1 since they did not cover a substantial part of the solid electrolyte disk and had an integrity separate from the said disk, the respondent considered that a coating with all these features was implicitly disclosed by D15 in the eyes of the skilled person. In particular, the respondent argued that in the technical field of solid electrolyte fuel cells, electrodes were usually provided in form of thin porous coatings or films on the surface of the solid electrolyte. At least as far as platinum are concerned, the common method of electrode application comprised painting a platinum ink or paste on the surface of the device and firing, nothing else being suggested by D15 (page 2079, left-hand column, section "4. Coating of …").

3.2.2 In the absence of evidence showing that in the field of solid oxide electrolyte fuel cells, electrodes were always and inevitably applied by coating the electrode material onto the solid electrolyte, the board concludes in favour of the appellant that D15 does not clearly and unambiguously disclose a "*coating*" of $La_{0.6}Sr_{0.4}CoO_3$.

3.3 The subject-matter of present claim 1 is thus novel (Articles 52(1) and 54(1)(2) EPC) over the disclosure of document D15. The other novelty objections raised by the respondent on the basis of further prior art documents need not be dealt with since the appeal fails for another reason (see below).

4. *Inventive step*

4.1 The patent in suit (see section [0001]) relates to the field of electrochemical reactors which facilitate the transfer of oxygen. In particular, it relates to oxygen semipermeable membranes, components for electrochemical reactors comprising the oxygen semipermeable membrane, electrochemical reactors and reactor components comprising the oxygen semipermeable membranes and catalyst, and electrochemical processes which use the oxygen semipermeable membrane and catalyst to facilitate electrochemical processes which utilize oxygen transport from an oxygen-containing gas to a gas that consumes oxygen.

4.2 The board accepts that in view of its similarity with the element according to the particular alternative of present claim 1 identified under point 2.1 herein above, a fuel cell as disclosed in D15 having the configuration H_2,Pt/ceria-yttria/$La_{0.6}Sr_{0.4}CoO_3$,O_2 (see point 3.1 above) can be considered to constitute the closest prior art.

4.3 In the light of document D15, the technical problem underlying the patent in suit as amended according to the present request can be seen in providing a further element for use in an electrochemical cell.

4.4 According to present claim 1, a particular solution to this technical problem is an "*element for use in an electrochemical cell*" which inter alia comprises as component "*(A)*" a "*solid multi component membrane characterised by (1) a solid electrolyte*" and as component "*(B)*" a "*conductive coating comprising a catalyst*" (emphasis added by the board).

4.5 The board is satisfied and it was not disputed that said technical problem is credibly solved by this claimed solution.

4.6 It remains to be decided whether this claimed solution to the technical problem is obvious in view of the cited prior art.

4.7 Starting from D15 and confronted with the stated technical problem, the skilled person would consider prior art documents also belonging to the technical field of solid oxide electrolyte fuel cells, including D3.

4.8 D3 discloses the deposition of a thin electrically conductive film of a material selected from perovskite-type oxides as oxygen cathode onto an oxygen ion conducting solid electrolyte (yttria stabilised zirconia). The deposition of the electrode film is carried out using a sputtering method. The perovskite-type oxides tested include those of formula $La_{1-x}Sr_xCoO_3$, e.g. $La_{0.7}Sr_{0.3}CoO_3$. Reference is made in particular to D3, title; abstract; page 241, first and last paragraph; page 242, section "2. Experimental", the first two paragraphs; Figures 1 and 4.

4.9 Considering that D3, like D15, relates to solid oxide electrolyte fuel cells with $La_{1-x}Sr_xCoO_3$ cathode materials, the skilled person would envisage "applying" the $La_{0.6}Sr_{0.4}CoO_3$ cathode material of the fuel cells described in D15 by depositing it in form of a thin film onto the solid electrolyte using the sputtering method known from D3 as a straightforward possibility for putting into practice the teaching of D15. By proceeding in that manner the skilled person would arrive at an "*element*" falling under present claim 1, comprising a solid electrolyte having deposited thereon a cathode of $La_{0.6}Sr_{0.4}CoO_3$ in form of a "*coating*" as understood by the appellant, without any inventive skills being involved.

4.10 For the board, it can be gathered from document D15 that a thin film deposited by sputtering onto the solid electrolyte can be considered as a "*coating*", see e.g. page 2079, left-hand column, section "4. Coating of …", second sentence. From the appellant's comments in this respect (see point VII herein above) it can also be inferred that it considers a film deposited in this manner to have no "integrity separate from the coated article", which in its view is a requirement for a layer of material qualifying as a "*coating*" in the sense of present claim 1.

4.11 The wording of present claim 1 merely refers to a "*conductive coating comprising a catalyst*" which may be "*associated to*" the cathode side ("*first surface*") of the "*solid electrolyte*". This wording does not, in the board's view, imply that "a substantial part of the coated article" has to be covered by said "*coating*". Even accepting for the sake of argument that Figure 6

of D15 - despite its schematic nature - disclosed a degree of coverage of the solid electrolyte disc by the cathode material of "significantly less than 50%", a film of $La_{0.6}Sr_{0.4}CoO_3$, deposited by a method as disclosed in D3 and covering the solid electrolyte to the extent shown in Figure 6, would thus also have to be considered as a coating - albeit partial. Moreover, in accordance with the opponent's arguments in this respect which remained undisputed, the board considers that when fabricating a fuel cell as a power source in accordance with the teaching of D15, the skilled person would generally aim at covering a substantial part of the available solid electrolyte surface area with the said cathode material in order to maximise the current output bearing in mind the maximum power density achievable (see table I of D15).

4.12 The board thus concludes that the particular alternative of present claim 1 identified under point 2.1 herein above, is lacking an inventive step as required by Articles 52(1) and 56 EPC.

Hence, there is no reason for the board to set aside the contested decision revoking the patent in suit.

Order

For these reasons it is decided that:

The appeal is dismissed.

The registrar | The Chairman

C. Vodz | G. Raths