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D E C I S I O N
of 20 September 2001

Case Number: T 0646/98 - 3.4.2

Application Number: 92101823.0

Publication Number: 0501187

IPC: H01M 10/40; H01M 4/58, H01M 4/48

Language of the proceedings: EN

Title of invention:
Nonaqueous electrolyte secondary battery

Patentee:
SONY CORPORATION

Opponents:
ALCATEL ALSTHOM CIE. GEN. D'ELECTRICITE
EVEREADY BATTERY COMPANY

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 123(2) and (3), 111

Keyword:
"Main, 1st auxiliary and 2nd auxiliary requests: inventive step (no)"
"3rd auxiliary request: change of category of the main claim (admissible)"

Decisions cited:
-

Catchword:
-



Case Number: T 0646/98 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 20 September 2001

Appellant: SONY CORPORATION
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 19 May 1998
revoking European patent No. 0 501 187 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: A. G. Klein
B. J. Schachenmann

Summary of Facts and Submissions

I. European Patent No. 0 501 187 (application No. 92 101 823.0) was revoked by the opposition division on the ground that the subject-matter of the claims as then under consideration, which were directed to a non-aqueous electrolyte secondary battery comprising *inter alia* a lithium compound oxide powder having a BET specific surface area in a given range, lacked an inventive step in view of the contents of document

D2: JP-A-01 304 664 (and English translation).

The opposition division held in particular that the ranges disclosed in document D2 for the particle size of the lithium compound oxide powder could be correlated to corresponding ranges for the BET specific surface area and that they were so broad as to inevitably cover the ranges defined in the patent in suit for the BET specific surface areas. In addition, the limits set out in the claims for the ranges of the BET specific surface areas did not delimit any surprising technical effect over particles having BET specific surface areas outside such limits.

II. The appellant (proprietor of the patent) filed an appeal against the decision revoking the patent.

III. Oral proceedings were held on 20 September 2001, which were not attended by respondent 2 (opponent 02), as had been announced in its letter of 16 August 2001.

The discussion at the oral proceedings concentrated on the teaching of document D2 and of the following

further document:

D8: EP-A-0 364 995.

At the end of the oral proceedings, the appellant requested that the decision under appeal be set aside and that, according to its main request, the patent be maintained in amended form on the basis of a claim which reads as follows:

"A non-aqueous electrolyte secondary battery comprising:

 a positive electrode containing lithium compound oxide powder Li_xCoO_2 (where x is between 0.05 and 1.10) as positive electrode active material,

 a non-aqueous electrolyte and

 a negative electrode containing carbonaceous material being doped and undoped with lithium upon charge and discharge,

wherein said lithium compound oxide powder has a BET specific surface area of 0.01 to 0.5 m^2/g ."

As its first auxiliary request, the appellant requested that the patent be maintained in amended form on the basis of the following claim:

"A non-aqueous electrolyte secondary battery having cylindrical form and comprising:

 a positive electrode containing lithium compound oxide powder Li_xCoO_2 (where x is between 0.05 and 1.10) as positive electrode active material,

 a negative electrode containing carbonaceous material being doped and undoped with lithium upon charge and discharge,

 separators,

a non-aqueous electrolyte and
a safety valve,
wherein said lithium compound oxide powder has a BET
specific surface area of 0.01 to 3.0 m²/g and
wherein the electrode body is obtained by placing said
negative electrode, a first separator, said positive
electrode and a second separator on each other to
obtain a four-layered laminate, and by spirally winding
said four-layered laminate to obtain a spiral electrode
assembly as the electrode body."

As its second auxiliary request, the appellant
requested that the patent be maintained in amended form
on the basis of the following claim, in which the
expression "two side" was corrected by the board to
"two sides", at its last occurrence:

"A non-aqueous electrolyte secondary battery having
cylindrical form and comprising:

- a positive electrode containing lithium compound
oxide powder Li_xCoO₂ (where x is between 0.05 and 1.10)
as positive electrode active material,
- a negative electrode containing carbonaceous
material being doped and undoped with lithium upon
charge and discharge,
- separators,
- a non-aqueous electrolyte and
- a safety valve,

wherein said lithium compound oxide powder has a BET
specific surface area of 0.01 to 3.0 m²/g and
wherein the electrode body is obtained by placing said
negative electrode, a first separator, said positive
electrode and second separator on each other to obtain
a four-layered laminate, and by spirally winding said
four-layered laminate to obtain a spiral electrode

assembly as the electrode body, wherein said positive electrode which incorporates a positive-electrode collector having two sides on each of which an active material for positive electrode has been formed and said negative electrode which incorporates a negative-electrode collector having two sides on each of which active material for the negative electrode has been formed."

Finally, as its third auxiliary request, the appellant requested that the patent be maintained in amended form on basis on the following claim:

"Method for assembling a non aqueous electrolyte secondary battery comprising:

- a positive electrode containing lithium compound oxide powder Li_xCoO_2 (where x is between 0,05 and 1,10) as positive electrode active material,
- a non-aqueous electrolyte and
- a negative electrode containing carbonaceous material being doped and undoped with lithium upon charge and discharge,

wherein a lithium compound oxide powder is provided and the specific surface area of the lithium compound oxide powder is measured by the BET-method and a lithium compound oxide powder is used that has a BET specific surface area of 0,01 to 0.5 m^2/g and the non-aqueous electrolyte secondary battery is assembled using said lithium compound oxide powder as positive electrode material."

The respondents for their part request that the appeal be dismissed.

IV. The appellant's arguments in support of his requests

can be summarised as follows.

The patent in suit is dedicated to the technical problem of improving the retention of capacity of non-aqueous electrolyte secondary batteries upon repeated charge and discharge cycles, whereby small improvements of such retention result in a substantial increase in the number of cycles which can be performed before the remaining capacity of the battery has dropped to 50% of its initial value, and thus in the life span of the battery.

This technical problem is not even mentioned in document D2, which merely teaches a preferable range between 10 and 150 μm for the average particle size in the lithium compound oxide powder, so as to provide a non-aqueous electrolyte secondary battery with high discharge voltage, high energy density and high discharge capacity characteristics.

Document D2 does not in any way suggest that controlling the BET specific surface area of the lithium compound oxide powder in the claimed range achieves any benefit in terms of capacity retention.

Controlling only the particle size as taught in document D2 would not necessarily result in the claimed range for the BET specific surface area, if not by accident. As a matter of fact average particle size and BET specific surface area are parameters which are not intimately correlated, as is evidenced in particular by the data in Appendix 1 filed by respondent 2 with its notice of opposition of 17 January 1997. Accordingly, secondary batteries comprising a lithium compound oxide powder manufactured in accordance with the process

disclosed in document D2, or a powder purchased from any commercial source on the basis of the average particle size recommended in document D2 would not consistently exhibit any improved retention of capacity.

The additional features set out in the claims of the first and second auxiliary requests, as directed in particular to the spirally wound electrode structure and to the pressure relief valve achieved still further advantages in terms of a reduction of the internal resistance of the battery and of its safety in use.

The third auxiliary request is directed to the method for assembling a battery as defined in the main request. The additional feature consists in a step of purposively selecting a lithium compound oxide powder by using the BET specific surface as the critical parameter. Thereby a high reproducibility city in the reproduction of batteries can be achieved.

V. The arguments put forward by the respondents can be summarised as follows.

If indeed average particle size and BET specific surface area are not closely correlated to each other when measured on various lithium compound oxide powders as commercially available, these parameters are nevertheless in direct correspondence when measured on powders obtained by a same process.

A lithium compound oxide powder was prepared on behalf of respondent 01 in accordance with the process

disclosed in details in document D2, as indicated in its letter of 18 February 1999, which exhibited a BET specific surface area of 0.48 m²/g, i.e. within the claimed range.

Document D2 also explicitly addresses the need for extending the life span of the battery and the effect of surface area on its performance (see page 2 of the English translation, 3rd paragraph and page 6, the 1st and 2nd full paragraphs).

In addition, retention of capacity upon charging and discharging cycles is an obviously desirable characteristic of a secondary battery. In this respect, it is noticed that comparative example H of the patent in suit, which uses a powder of a specific surface area outside the claimed range nevertheless presents a retention capacity which is even better than in the claimed range, which casts doubt on the technical character of the claimed subject-matter.

In respect of the appellant's first and second auxiliary requests, both the patent in suit (see the penultimate paragraph of the specification) and document D2 (see page 4 of the English translation, the 2nd full paragraph) show that the lithium compound oxide powders described there are equally applicable to coin type, button type or coil type batteries, amongst others.

As far as the third auxiliary request is concerned, the same requests apply as for the main request.

Reasons for the Decision

1. The appeal is admissible.

2. *Appellant's main request.*

2.1 Novelty

2.1.1 Document D2 discloses a non-aqueous electrolyte secondary battery comprising a positive electrode containing a lithium compound oxide powder LiCoO_2 as positive electrode active material and a non-aqueous electrolyte (see the passages "Preparation of material for positive electrode" and "Assembly of battery" on pages 4 and 5 of the English translation).

In this embodiment, the negative electrode is formed of a lithium foil, and the lithium compound oxide powder of the positive electrode is characterised by way of its average particle size, which is between 5 and 300 μm , no value being given for its BET specific surface area.

Thus, the subject-matter of claim 1 is distinguished from the secondary battery disclosed in document D2 in that the negative electrode contains carbonaceous material subject to doping and undoping with lithium upon charge and discharge of the battery, and in that the BET specific surface area of the lithium compound oxide powder of the positive electrode is specified to be in the range between 0.01 and 0.5 m^2/g .

2.1.2 Document D8 discloses a non-aqueous electrolyte secondary battery comprising a positive electrode containing lithium compound oxide powder LiCoO_2 , a non-aqueous electrolyte and a negative electrode containing carbonaceous material being subject to doping and

undoping with lithium upon charge and discharge (see page 7, lines 16 to 52).

The document does not provide details of the structure and physical properties of the lithium compound oxide powder of the positive electrode.

2.1.3 The other documents on the file do not come closer to the claimed subject-matter which, accordingly, is novel within the meaning of Article 54 EPC.

2.2 Inventive step

2.2.1 Like the patent in suit, document D2 is dedicated to evaluating the effect of the physical structure of a lithium compound oxide powder on the performance of a non-aqueous electrolyte secondary battery in which it forms the positive electrode active material. The Board can therefore endorse the parties' view that the specific embodiment disclosed in this document represents the closest prior art.

2.2.2 The subject-matter of claim 1 of the appellant's main request is distinguished from the secondary battery of document D2, on the one hand, in that it comprises a negative electrode containing carbonaceous material instead of the lithium foil used in the specific example of document D2.

In respect of the negative electrode material, document D2 however explicitly discloses the possibility of replacing metallic lithium and lithium alloy materials by any substances that can be cyclically doped and undoped with lithium upon charge and discharge, such as pitch, tar or cokes, i.e.

carbonaceous material within the meaning of claim 1 (see the paragraph bridging pages 3 and 4 of the English translation). The use of such carbonaceous material was well known at the priority date of the patent in suit, as is evidenced also by document D8 (see page 7, lines 36 to 38).

The appellant did not in the proceedings rely on the choice of the claimed negative electrode material in support of an inventive step.

Accordingly, the composition of the negative electrode as set out in claim 1 in the board's view is an obvious alternative to the lithium foil of the specific example of document D2.

- 2.2.3 On the other hand, the secondary battery of the claim of the appellant's main request is distinguished from the specific embodiment of document D2 in that the lithium compound oxide powder of its positive electrode is specified as having a BET specific surface area of 0.01 to 0.5 m²/g. This characteristic is technically independent of the particular choice of the negative electrode material in accordance with the first distinguishing feature.

Respondent 1 submitted that preparing a lithium compound oxide powder in accordance with the indications in document D2 resulted in a powder having a BET specific surface area of 0.48 m²/g i.e. in the claimed range (see its letter of 18 February 1999, page 3). Respondent 2 also filed with the Appendix 1 attached to its notice of opposition dated 17 January 1997 BET specific surface area measurement data obtained from a number of powder samples as

commercially available both before and after the priority date of the patent, and from powders manufactured in accordance with the teaching of various prior art documents. Many of these measurements data fall within the claimed range.

The appellant did not deny that the experimental data forwarded by both respondents were correct. He relied upon them to show that there was no clear correlation between the measured BET specific surface areas of such powders and their average particle sizes. Accordingly, a skilled person who would either prepare himself or obtain from commercial sources lithium compound oxide powders with the average particle size recommended in document D2 could not in the appellant's opinion achieve the claimed BET specific surface area values in any consistent way, if not by chance.

In the board's view, the experimental data produced by the respondents and not contested by the appellant indeed show that applying the teaching of document D2 may indeed lead to the obtaining of lithium compound oxide powders having a BET specific surface area varying in a broad range of values. A non negligible proportion of the powders so obtained would however inevitably meet the claimed limitation.

The limitation set out in claim 1 as to the BET specific surface area of the claimed lithium compound oxide powder does not therefore express any reliable distinction over the powder taught by document D2.

- 2.2.4 For these reasons, the subject-matter of claim 1 of the appellant's main request does not involve an inventive step within the meaning of Article 56 EPC.

- 2.3 The subject-matter of the claim with accordance with the appellant's main request lacking an inventive step, the patent cannot be maintain as amended on the basis of this claim, in accordance with Article 102(3) (EPC).

The appellant's main request cannot be allowed, accordingly.

3. *Appellant's first and second auxiliary requests*

The claims of the appellant's first and second auxiliary requests define a still broader product range for the BET specific surface area of the lithium compound oxide powder (between 0.01 and 3.0 m²/g), and they comprise additional features directed to the presence of separators and of a safety valve, to an electrode body structure formed by spirally winding a four-layered laminate, and to two-sided electrode collectors.

Whilst the specific embodiment disclosed in document D2 comprises a button cell, the teaching of the document also applies to different battery shapes, and in particular to batteries of the coil or tubular type, as indicated explicitly in the second full paragraph of page 4 of the English translation.

Such coil or tubular type battery, which also comprises a lithium compound oxide powder and a non-aqueous electrolyte is disclosed for instance in document D8, and it comprises all the additional features of the claims of the appellant's first and second auxiliary requests (see page 3, lines 26 to 33 and page 7, lines 16 to 62).

The appellant stressed the advantage of these additional features in terms of an increased safety of the battery and of a reduced internal resistance. The very same advantages are however already provided by these features when used in the secondary battery of document D8.

For these reasons, the claims of the appellant's first and second auxiliary requests in the board's opinion result from the obvious incorporation into the closest prior art device of document D2 of the battery design disclosed in document D8.

Appellant's first and second auxiliary requests cannot therefore be allowed either.

4. *Appellant's third auxiliary request*

4.1 The claim of the appellant's third auxiliary request is directed to a method for assembling a non-aqueous electrolyte secondary battery.

4.2 Compliance of the amended claim with the requirements of Article 123(2) and (3) EPC.

4.2.1 The amended claim defines a method for assembling secondary battery which itself comprises all the features of the device claim of the main request. Apart from the upper limit of the claimed range for the BET specific surface area of 0.01 to 0.5 m²/g these features were set out already in claim 1 as originally filed. The introduction of the new upper limit for the BET specific surface area at 0.5 m²/g is supported by the original disclosure of the characteristics of battery C

in Table 1.

In substance, the present method claim only comprises the further additional feature that the specific surface area of the lithium compound oxide powder "is measured by the BET-method". Such measurement, and the subsequent assembly of a secondary battery electrode was disclosed in the application as originally filed in particular in conjunction with the description of examples A to H. The board notes in this respect that the measurement step is not described explicitly, but the necessity of performing such step directly follows from the indication of the measurement results in the original application documents.

- 4.2.2 With respect to the scope of protection afforded by the amended claim as compared to the scope of claim 1 as granted, the category of the claim was changed from a device claim directed to a battery to a method claim directed to a method for assembling such battery.

According to established case law of the boards of appeal of the EPO, a change of the category from a product claim to a claim for the manufacturing of the product does not in principle extend the scope of protection of the claim, for a product claim achieves an absolute protection which extends to the manufacturing and use of the product.

In the present circumstances, claim 1 as granted being directed to a secondary battery as such, it covered any method for assembling such battery, independently of whether the BET specific surface area of the lithium compound oxide powder in the claimed range was achieved by chance, or as a result of a specific measurement of

that parameter.

In contrast, the present claim now only covers a method for assembling a secondary battery in which the claimed BET specific surface area range is achieved on purpose, following an appropriate measurement of this parameter by the BET-method.

4.2.3 For these reasons, the amendments brought to the claim in accordance with the appellant's third auxiliary request meet the requirements of Article 123(2) and (3) EPC.

4.3 Further prosecution

The claim of the appellant's third auxiliary request as presented at the oral proceedings before the board of appeal for the first time comprises the limitation that a BET specific surface area measurement is performed so as to achieve the claimed range.

The impact of this feature on the issue of the patentability of the claimed subject-matter has not been examined so far. As a matter of fact, the discussion in the opposition and in the appeal procedures essentially concentrated on whether the claimed BET specific surface area values and the average particle size values disclosed in document D2 defined the same materials, and the conclusion of both the opposition division and the present board was that these definitions did not express any patentable distinction.

The question of whether there was any obvious reason for the skilled person to proceed to a BET specific

surface area measurement as a means for selecting a proper lithium compound oxide powder for assembling a non-aqueous electrolyte secondary battery raises different issues, which have not yet been fully addressed by the parties.

In consideration also of the fact that respondent 2 did not attend the oral proceedings at which this feature was introduced for the first time in the appellant's claim, the Board deems it appropriate in the present circumstances to make use of the possibility afforded to it by Article 111(1) EPC to remit the case to the opposition division for further prosecution.

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 for further prosecution based on auxiliary request No. 3 filed by the appellant during the oral proceedings of 20 September 2001.

The Registrar:

The Chairman:

P. Martorana

E. Turrini