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**D E C I S I O N**  
**of 3 July 2002**

**Case Number:** T 0525/01 - 3.4.2

**Application Number:** 96924524.0

**Publication Number:** 0876684

**IPC:** H01M 4/64

**Language of the proceedings:** EN

**Title of invention:**

Material and method of low internal resistance Li-ion battery

**Applicant:**

Telcordia Technologies, Inc.

**Opponent:**

-

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 56, 52(1)

**Keyword:**

"Inventive step - no"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 0525/01 - 3.4.2

**D E C I S I O N**  
**of the Technical Board of Appeal 3.1.1**  
**of 3 July 2002**

**Appellant:** Telcordia Technologies, Inc.  
445 South Street  
Morristown, NJ 07960 (US)

**Representative:** Dubois-Chabet, Guy  
BREVALEX  
3, rue du Docteur Lanceriaux  
F-75008 Paris (FR)

**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 22 November 2000  
refusing European patent application  
No. 96 924 524.0 pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** B. J. Schachenmann  
**Members:** M. P. Stock  
M. A. Rayner

## Summary of Facts and Submissions

I. The present appeal is against the decision of the examining division to refuse European patent application 96 924 524.0 for lack of an inventive step. Reference was made to the following prior art documents:

D1: US-A-5 368 959

D2: US-A-4 772 517

D3: US-A-4 540 641

D4: US-A-5 478 668

The examining division held that the claimed subject-matter differed from what is disclosed in D2 or D3 substantially only in that the current collectors on both the anode and cathode side have the described structure (i.e. metallic elements coated with conductive polymeric composition). However, this choice was obvious for a person skilled in the art.

II. In the written statement setting out the grounds for appeal, the appellant requested that the decision of the examining division be set aside and that a patent be granted on the basis of a set of amended claims 1 to 21. The independent claims read as follows:

"1. A method of making a low internal resistance battery comprising positive and negative electrode members having a separator member disposed therebetween and respective current collector members in contact therewith

characterized in that  
said collector members comprise metallic current  
collector elements and, prior to said collector members  
being bonded directly to said electrode members,  
a) the surfaces of said collector elements are  
cleaned of insulative materials; and  
b) said cleaned collector elements are coated with an  
adherent electrically-conductive polyolefin-based  
polymeric composition."

"4. A method of making a rechargeable battery which  
comprises arranging positive and negative electrode  
body members with a separator member disposed  
therebetween, each of said electrode and separator  
members comprising a flexible, polymeric film  
composition including a compatible plasticizer  
therefor; arranging respective flexible  
electrically-conductive current collector members in  
contact with said electrode members; and bonding each  
said member to contiguous members to form a unitary  
flexible laminate battery structure  
characterized in that  
said collector members comprise metallic current  
collector elements and prior to arranging said  
collector members such that they are bonded directly to  
said electrode members,  
a) the surfaces of said collector elements are  
cleaned of insulative materials; and  
b) said cleaned collector elements are coated with an  
adherent electrically-conductive polyolefin-based  
polymeric composition."

"12. A low internal resistance rechargeable battery  
comprising positive and negative electrode body members  
with a separator member disposed therebetween, each of

said electrode and separator members comprising a flexible, polymeric film composition, and respective flexible electrically-conductive current collector members bonded directly to said electrode members, each said member being bonded to contiguous members to form a unitary flexible laminate battery structure characterized in that

- a) said collector members comprise metallic current collector elements the surfaces of which have been cleaned of insulative materials; and
- b) said cleaned collector elements are coated with an adherent electrically-conductive polyolefin-based polymeric composition, to effectuate bonding directly to an electrode."

The arguments of the appellant can be summarised as follows:

The problem solved by the present invention is to reduce the internal resistance factor of a battery by preventing the formation of metallic oxides on the surfaces of the current collectors, as well as the insulating effect of electrolyte solution wetting the electrode/collector interface. This problem is solved by cleaning the surfaces of the collector elements of insulative oxides and by coating the cleaned collector elements with an adherent conductive polymeric composition.

D2 discloses a composite electrode whose active electrode material contains an electrochemically oxidisable and/or reducible polymer and a conductor (aluminium) bonded to it by means of an adhesive layer (polyisobutylene composition) containing finely divided conductive substances (carbon black or graphite

filler). The adhesive layer of D2 has not for object to prevent the formation of insulating oxides on the conductor element but to create a strong bond between the conductor and the active electrode material which is a polymer. In the present invention the polymeric coating has not for object to bond a metal collector element to an active electrode material. Therefore the structure of the D2 device is not the same as that of the present invention. The invention requires a current collector having a polymeric coating. D2 requires a doped polyisobutylene "paste" which is not part of the invention. Furthermore, there is nothing in D2 about the use of the coated metallic collector element for both the anode and cathode.

D3 relates to an electrochemical cell in which a cathode current collector is in contact with a reducible cathode material dissolved in an electrolytic solution. Although the cathode current collector includes a polymer which may be in the form of a thin film adherent to a conductive substrate, this film is different from the one of the present invention which is coated on a cleaned collector element bonded to an electrode member. The film has not for object to prevent the formation of insulating metallic oxides and to avoid the insulating effect of electrolyte solution wetting the electrode/collector interfaces, since in D3 the cathode material is dissolved in the electrolyte and there are no such interfaces.

III. In an annex to the summons to oral proceedings requested by the appellant, the board introduced the following prior art document cited at page 8, line 29 of the present application into the procedure:

D5: US-A-5 470 357

In a provisional opinion the board argued that the subject-matter of the independent claims lacked an inventive step.

With his letter dated 4 June 2002 the appellant informed the board that he did not wish to attend the oral proceedings. He provided no further arguments in response to the provisional opinion of the board.

The oral proceedings before the board took place on 3 July 2002 in the absence of the appellant. At the end of the oral proceedings the decision of the board was given.

## **Reasons for the Decision**

### *1. Admissibility of the appeal*

The appeal complies with the provisions of Articles 106 to 108 and Rules 1(1) and 64(b) EPC and is therefore admissible.

### *2. Inventive step*

- 2.1 Document D5, see Figure 1 with the associated description and column 2, lines 1 to 28, discloses a method of making a low internal resistance battery comprising positive (17) and negative (13) electrode members having a separator member (15) disposed therebetween and respective current collector members (19, 11) in contact therewith, wherein said collector members comprise metallic current collector elements

and, prior to said collector members being bonded directly to said electrode members,  
a) the surfaces of said collector elements are cleaned of insulative materials (see column 7, lines 23 to 29); and  
b) said cleaned collector elements are coated with an adherent electrically-conductive polymeric composition (VdF:HFP copolymer).

The subject-matter of claim 1 differs from this prior art in that the polymeric composition is polyolefin-based. This solves the problem of increased resistance between electrode and collector foil due to degradation by electrolyte solutions, see present application, page 9, lines 4 to 10.

This problem is also addressed in document D2, see column 1, lines 59 to 63, disclosing a method of making a composite electrode for a battery, in which a cleaned metallic current collector element (aluminum sheet) is coated with a polyolefin-based polymeric composition (by applying a solution of polyisobutylene to the aluminium sheet and evaporating the solvent), whereby a current collector member is obtained, and this current collector member is bonded directly (by means of gentle pressure) to an electrode member (polypyrrole film), see column 5, lines 24 to 35, and column 6, lines 28 to 34.

Therefore it was obvious for a person skilled in the art to use the polyolefin-based composition disclosed in D2 in the method known from D5 and thus arrive at the subject-matter of claim 1.

2.2 Another approach would be to start from document D2



when considering inventive step.

The composite electrode described in D2 is for use in electrochemical cells. i.e. in batteries, see column 1, lines 4 to 13. Therefore such a composite electrode can correspond to the electrode members and respective current collector members defined in claim 1. Hence, D2, see column 5, lines 24 to 35 (Example 2), discloses a method in which a metallic current collector element (aluminum sheet) is cleaned (of insulative oxides, which is implicit in the context), the cleaned metallic current collector element is coated with a polyolefin-based polymeric composition (by applying a solution of polyisobutylene to the aluminium sheet and evaporating the solvent), whereby a current collector member is obtained, and this current collector member is bonded directly (by means of gentle pressure) to an electrode member (polypyrrole film).

Having regard to the intended use of the composite electrode for a battery, D2 also discloses a method of making a battery having positive and negative electrodes and a separator member therebetween.

D2 leaves the choice to the skilled person to employ the composite electrode for one of the electrodes only (cathode, see column 1, lines 17 to 34) or for both electrodes (see column 1, lines 59 to 63, and column 2, lines 24 to 27). According to present claim 1, coated current collector elements are used for both negative and positive electrodes. However, this choice, if not known from D2, in any case was obvious for a person skilled in the art, since batteries employing polymeric active materials for positive (17) and negative electrodes (13) are known in the art, see D4, Figure 1

and column 4, lines 54 to 67, or D5, Figure 1 and column 3, lines 23 to 39.

- 2.3 The method according to claim 4 which in addition to claim 1 specifies the battery being **rechargeable** and the electrode and separator members comprising a **flexible, polymeric** film composition including a compatible **plasticiser**, again differs from what is disclosed in D5 by the polymeric composition being polyolefin-based. However, this selection was obvious in view of D2 for the reasons given in item 2.1 above.
- 2.4 As claim 12 is not directed to a method, but to a device (battery), the feature "the surfaces of which have been cleaned of insulative materials" is understood as "the surface of which is free of insulative materials to a degree as obtainable by cleaning". It is concluded that the subject-matter of claim 12 was obvious from D2 and D5 for the reasons given in item 2.2 above.
- 2.5 No arguments of the appellant responsive to the above reasoning which was included in the annex to the summons of the oral proceedings are available.
- 2.6 Accordingly, the application does not meet the requirements of Article 52(1) EPC because the subject-matter of claims 1, 4 and 12 does not involve an inventive step in the sense of Article 56 EPC.

## **Order**

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

The appeal is dismissed.

The Registry:

The Chairman:

P. Martorana

B. Schachenmann