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# Datasheet for the decision of 28 October 2024

**Case Number:** T 2308/22 - 3.3.05

**Application Number:** 17160906.8

**Publication Number:** 3279977

**IPC:** C01G53/00, H01M4/131, H01M4/1391, H01M4/38, H01M4/525, H01M10/0525, H01M4/02, H01M4/48, H01M4/50, H01M4/505, H01M4/36

**Language of the proceedings:** EN

**Title of invention:**
LITHIUM COMPLEX OXIDE FOR LITHIUM SECONDARY BATTERY POSITIVE ACTIVE MATERIAL AND A METHOD OF PREPARING THE SAME

**Patent Proprietor:**
ECOPRO BM CO., LTD.

**Opponent:**
JOHNSON MATTHEY PUBLIC LIMITED COMPANY

**Headword:**
Lithium complex oxide/ECOPRO

**Relevant legal provisions:**
EPC Art. 54, 56, 83

**Keyword:**
Novelty - main request (yes)
Inventive step - main request (yes)
Sufficiency of disclosure - (yes)

**Decisions cited:**

**Catchword:**

Europäisches Patentamt
European Patent Office
Office européen des brevets

**Beschwerdekammern**

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**Case Number: T 2308/22 - 3.3.05**

# D E C I S I O N
# of Technical Board of Appeal 3.3.05
# of 28 October 2024

| | |
|---|---|
| **Appellant 1:**<br>(Patent Proprietor) | ECOPRO BM CO., LTD.<br>100, 2 Sandan-ro<br>Ochang-eup<br>Cheongwon-gu<br>Cheongju-si, Chungcheongbuk-do 28117 (KR) |
| **Representative:** | J A Kemp LLP<br>80 Turnmill Street<br>London EC1M 5QU (GB) |
| **Appellant 2:**<br>(Opponent) | JOHNSON MATTHEY PUBLIC LIMITED COMPANY<br>5th Floor<br>25 Farringdon Street<br>London EC4A 4AB (GB) |
| **Representative:** | Mewburn Ellis LLP<br>Aurora Building<br>Counterslip<br>Bristol BS1 6BX (GB) |
| **Decision under appeal:** | **Interlocutory decision of the Opposition Division of the European Patent Office posted on 9 August 2022 concerning maintenance of the European Patent No. 3279977 in amended form.** |

**Composition of the Board:**

| | |
|---|---|
| **Chair** | E. Bendl |
| **Members:** | T. Burkhardt |
| | P. Guntz |

## Summary of Facts and Submissions

I. The appeals of both the patent proprietor (appellant 1) and the opponent (appellant 2)are against the opposition division's decision to maintain European patent No. 3 279 977 B1 as amended in the form of auxiliary request 3 then on file.

II. Of the documents discussed at the opposition stage, the following are relevant to the present decision:

D1 WO 2013/025328 A2

D2 WO 2017/189887 A1

D8 A. Diamond, "Document O8 - Experimental Report - Characterisation of a lithium complex oxide material produced according to Example 2 of WO 2013/025328 A2", 8 December 2020, 1-6

D9 EP 3 315 638 A1

D12 KR 2016 0087527 A

D12a English translation of D12

D14 "Experimental Report 2, Advantages of the Invention", 1-4

III. At the oral proceedings at the appeal stage, the patent proprietor made auxiliary request 3 as submitted on 2 October 2024 its new main and sole request.

This request is identical to auxiliary request 8 as submitted with the patent proprietor's grounds of appeal.

All other claim requests on file were withdrawn.

IV. Broken down into features, independent claim 1 of the main request reads as follows:

F1.1 "1. A lithium complex oxide secondary particle formed by coagulation of a plurality of primary particles, wherein the Co concentration at a boundary of the primary particle is higher than the Co concentration in the internal part of the primary particle,

F1.2 wherein: the Co concentration of a primary particle at a part of the primary particle which is in contact with the surface of the secondary particle is higher than at a part of the primary particle that is not in contact with the surface of the secondary particle, wherein the primary particle is located at a surface part of the secondary particle;

F1.3 a primary particle located at a surface of the secondary particle has a Co ion concentration gradient toward a center of the primary particle from the surface of the primary particle;

F1.4 a primary particle located at a surface part of the secondary particle has a Co concentration gradient that is reduced by 0.05 to 0.07 mol% per nm toward a center of the primary particle;

F1.5 the lithium complex oxide secondary particle comprises a hexagonal crystal structure;

F1.6 the secondary particle has a bound energy (P1) of spin-orbit 2p3/2 peak and a bound energy (P2) of 2p1/2 peak in a Co 2p core-level spectrometry obtained through XPS measurement, wherein the P1 and the P2 are ranged respectively in $779eV \leq P1 \leq 780eV$ and $794eV \leq P2 \leq 795eV$; and

F1.7 the secondary particle is given by the following Formula 1,
[Formula 1] $Li_xNi_{1-(a1+b1+c1)}Co_{a1}M1_{b1}M2_{c1}M3_dO_y$,
wherein, in the Formula 1, M1 is Mn or Al, and M2 and M3 are metals selected from a group of Al, Ba, B, Co, Ce, Cr, F, Li, Mg, Mn, Mo, P, Sr, Ti, and Zr, and wherein $0.95 \leq x \leq 1.05$, $1.50 \leq y \leq 2.1$, $0.02 \leq a1 \leq 0.25$, $0.01 \leq b1 \leq 0.20$, $0 \leq c1 \leq 0.20$, and $0 \leq d \leq 0.20$."

Independent claim 6 of the main request reads as follows:

"6. A method of preparing a lithium complex oxide secondary particle of any one of the preceding claims, the method comprising:
manufacturing precursors of lithium secondary battery positive active materials given by the following Formula 2,
[Formula 2]$Ni_{1-(x2+y2+z2)}Co_{x2}M1_{y2}M2_{z2}(OH)_2$,
wherein, in Formula 2, M1 is Mn or Al, and M2 is a metal selected from a group of Al, Ba, B, Co, Ce, Cr, F, Li, Mg, Mn, Mo, P, Sr, Ti, and Zr, and wherein $0 \leq x2 \leq 0.25$, v$0 \leq y2 \leq 0.20$, and $0 \leq z2 \leq 0.20$;
reacting precursors of lithium secondary battery positive active materials with a lithium compound and manufacturing a positive active material by first thermal treating the reactant;
washing the positive active material with distilled water or an alkaline solution;
reactively coating the washed positive active material with a solution containing M2 being Co;
drying particles of the positive active material; and
mixing the dried positive active material with M3 that is a metal selected from the group of Al, Ba, B, Ce, Cr, F, Li, Mg, Mn, Mo, P, Sr, Ti, and Zr and doping the

metal M3 into the particles by second thermal treating the mixture."

Dependent claims 2 to 5 and 7 to 10 relate to embodiments.

V. As announced, the opponent did not attend the oral proceedings at the appeal stage.

VI. The arguments put forward by the opponent during the appeal proceedings which are relevant to the present decision can be summarised as follows:

The invention of the patent as granted was insufficiently disclosed on account of feature F1.4.

The subject-matter of dependent product claim 6 of the patent as granted (the feature of which has been added to claim 1 of the current main request) was not novel over D1, D2 or Embodiments 1 to 4 of D9.

Moreover, the subject-matter of independent method claim 7 as granted (which is identical to claim 6 of the current main request) was neither novel over Embodiments 1 to 4 of D9 nor inventive over D1.

The first priority of D9 was valid and D9 was therefore to be considered a document under Article 54(3) EPC.

VII. The patent proprietor's arguments at the appeal stage are reflected in the reasons below.

VIII. The patent proprietor requested that the decision under appeal be set aside and that the patent be maintained as amended on the basis of the main (sole) request, submitted as auxiliary request 3 on 2 October 2024.

The opponent requested in writing that the decision under appeal be set aside and the patent be revoked.

## Reasons for the Decision

1. Main request

The admission/consideration of this request was not contested.

Similarly, no objections were raised against this request.

The patent proprietor indicated that claim 10 of the application as originally filed (corresponding to claim 6 as granted) was the basis for the new feature ("Formula 1") in claim 1 of the current main request.

The board sees no reason to view this differently.

1.1 Sufficiency of disclosure

No objections under Article 83 EPC were raised against this request. Even if it were assumed that the opponent's objection under Article 83 EPC against feature F1.4 of claim 1 of the patent as granted also applied to the main request, this objection would not be successful.

The patent in suit contains numerous examples and also indications in the general disclosure that explain how

the claimed particle can be obtained. **D14** (see the table on page 2) shows that it is possible to obtain and measure the Co concentration gradient. Even **D8** (Table 1), which was provided by the opponent, confirms that it is possible to obtain a Co concentration gradient and to measure it.

Moreover, the skilled person knows how to adjust such a gradient (e.g. by adjusting the rate of Co diffusion).

Furthermore, the opponent provided no evidence to the contrary.

There is consequently no reason to doubt that the main request meets the requirements of Article 83 EPC.

1.2 Novelty and inventive step

No objections under Articles 54 and 56 EPC were raised against the main request.

Even if it were assumed that the opponent's novelty and/or inventive-step objections against the patent as granted with respect to D1, D2 and Embodiments 1 to 4 of D9 also applied to the independent claims of the main request, *arguendo*, these objections would not be convincing for the reasons set out below.

1.2.1 As regards Example 2 of **D1**, the lithium complex oxide does not contain Mn or Al. Concerning the general disclosure of D1, Formula 2 (see paragraph [0048]) indicates that Mn and/or Al can be present. However, there is no evidence that features F1.2 and F1.3 are then respected. **D8** shows this only for Example 2 of D1.

1.2.2 The oxides of Examples 1 and 2 of **D2** do not contain Mn, and the amounts of Al, i.e. 0.004 and 0.006 (paragraphs [0074] and [0082]), are below the claimed range of $0.01 \leq b1 \leq 0.20$.

Moreover, no evidence was provided to show that the effect of improved "capacity, resistance, and battery lifetime as well as reducing residual lithium" (see paragraph [0011] of the patent in suit) has not been achieved over D1 and D2.

1.2.3 The opposition division was correct when concluding that **D9** was not part of the state of the art (see points II.4.9 to II.4.12 of the decision under appeal; in particular the table in II.4.10).

D9 claims a first priority from **D12/D12a**. However, in accordance with paragraphs [0065], [0080], [0092] and [0108] of D12/D12a, only LiOH was added to the precursors when preparing Embodiments 1 to 4, in contrast to paragraphs [0038], [0047], [0053] and [0061] of D9 where both LiOH and $Li_2CO_3$ were added. The fact that Table 1 of D12/D12a mentions both LiOH and $Li_2CO_3$ as "residual lithium" and that paragraph [0007] states that "residual lithium" relates to "unreacted LiOH and $Li_2CO_3$" cannot prove that $Li_2CO_3$ was necessarily added to the precursors during manufacturing (which would not be in line with the statement of paragraph [0065] of D12/D12a). The term "unreacted [LiOH and $Li_2CO_3$]" in paragraph [0007] of D12/D12a also cannot imply that $Li_2CO_3$ was added to the precursors during the manufacturing of the embodiments.

Moreover, there are further differences between D12/D12a and D9:

- the drying temperature (paragraph [0040] of D9 vs. paragraph [0068] of D12/12a)
- the temperature of the second heat treatment (paragraph [0041] of D9 vs. paragraph [0068] of D12/12a)

The opponent alleged that the drying temperature and the temperature of the second heat treatment had no influence on the manufactured products. However, there is no proof and therefore such an influence cannot be excluded.

The first priority of D9 is thus invalid as far as the subject-matter of Embodiments 1 to 4 is concerned.

Moreover, since the second priority date of D9 is identical to that of the patent in suit and since the validity of the latter has not been contested, D9 is not to be considered prior art as far as the subject-matter of Embodiments 1 to 4 is concerned.

1.2.4 These conclusions also apply to dependent claims 2 to 5 and 7 to 10.

1.2.5 Consequently, there is no reason to doubt that the main request meets the requirements of Articles 54 and 56 EPC.

**Order**

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

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent in amended form on the basis of the main request, submitted as auxiliary request 3 on 2 October 2024 and a description to be adapted.

The Registrar: The Chair:

A. Wille E. Bendl

Decision electronically authenticated