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Datasheet for the decision of 8 September 2022

Case Number: T 0274/21 - 3.3.05

Application Number: 16196072.9

Publication Number: 3163656

IPC: H01M4/505, H01M4/525, H01M4/36, C01G23/00, C01G45/12, C01G51/00, C01G53/00, H01M4/485, H01M4/62, H01M10/052

Language of the proceedings: EN

Title of invention:

COMPOSITE POSITIVE ELECTRODE ACTIVE MATERIAL, POSITIVE ELECTRODE INCLUDING THE SAME, AND LITHIUM BATTERY INCLUDING THE POSITIVE ELECTRODE

Patent Proprietor:

Samsung Electronics Co., Ltd.
Samsung SDI Co., Ltd.

Opponent:

Haldor Topsoe A/S

Headword:

Composite Positive Electrode Active Material/Samsung

Relevant legal provisions:

EPC Art. 54, 56, 84

Keyword:

Novelty - Main Request (no) - Auxiliary Request 3 (no)
Inventive step - Auxiliary Request 5b (no) - Auxiliary request 9 (no) - Auxiliary Request 10a (yes)
Claims - clarity Auxiliary Request 10 (no)

Decisions cited:

Catchword:

Europäisches Patentamt
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Beschwerdekammern

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Case Number: T 0274/21 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 8 September 2022

Appellant: (Opponent)	Haldor Topsoe A/S Haldor Topsoes Allé 1 2800 Kongens Lyngby (DK)
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Representative:	Elkington and Fife LLP Prospect House 8 Pembroke Road Sevenoaks, Kent TN13 1XR (GB)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 28 January 2021 rejecting the opposition filed against European patent No. 3163656 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	E. Bendl
Members:	S. Besselmann
	S. Fernández de Córdoba

Summary of Facts and Submissions

I. This appeal, by the opponent (appellant), is against the opposition division's decision to reject the opposition against European patent EP 3 163 656 B1. The patent in suit concerns a composite positive electrode active material, a positive electrode including the same, and a lithium battery including the positive electrode.

II. The following documents are of relevance here:

D1 CN 101447566 B

D1b human translation of D1

D3 US 6,379,842 B1

III. Independent claim 1 of the patent as granted (main request) relates to a composite positive electrode active material and reads as follows:

"1. A composite positive electrode active material comprising:
a compound represented by Formula 3:

Formula 3

$xLiMO_2 \cdot yLiMe_2O_4$

wherein, in Formula 3 x+y=1, 0 < x < 1, and 0 < y < 1; M and Me are each independently at least one element selected from Groups 2 to 14 of the periodic table, and a molar ratio of Li/(M+Me) in the composite is less than 1, wherein the compound represented by Formula 3 includes a first metal oxide that has a layered structure and is represented by Formula 1; and a second metal oxide that has a spinel structure and is represented by Formula 2,

Formula 1 $LiMO_2$

Formula 2 $LiMe_2O_4$."

IV. Independent claim 1 of each of auxiliary requests 1, 1a and 1b and 2, 2a and 2b differs from the main request in that the feature "0 < x < 1, and 0 < y < 1" is replaced by the following definitions, respectively:

In auxiliary request 1:
"0.75 < x < 0.99 and 0.01 < y < 0.25"

In auxiliary requests 1a and 1b:
"x is in a range of 0.75 to 0.99; and y is in a range of 0.01 to 0.25"

In auxiliary request 2:
"0.85 < x < 0.99 and 0.01 < y < 0.15"

In auxiliary requests 2a and 2b:
"x is in a range of 0.85 to 0.99; and y is in a range of 0.01 to 0.15"

V. Independent claim 1 of auxiliary request 3 reads as follows, with deletions in comparison with the main request being shown by strikethrough and additions underlined:

"1. A composite positive electrode active material ~~comprising:~~,
wherein the composite positive electrode material is a compound represented by Formula 3:

Formula 3

$xLiMO_2 \cdot yLiMe_2O_4$

wherein, in Formula 3 x+y=1, 0 < x < 1, and 0 < y < 1;

M and Me are each independently at least one element selected from Groups 2 to 14 of the periodic table, and a molar ratio of Li/(M+Me) in the composite is less than 1, wherein the compound represented by Formula 3 includes a first metal oxide that has a layered structure and is represented by Formula 1; and a second metal oxide that has a spinel structure and is represented by Formula 2,

Formula 1 $LiMO_2$

Formula 2 $LiMe_2O_4$."

VI. Independent claim 1 of each of auxiliary requests 4, 4a and 4b and 5, 5a and 5b differs from auxiliary request 3 in that the feature "0 < x < 1, and 0 < y < 1" is replaced by the following definitions, respectively:

In auxiliary request 4:
"0.75 < x < 0.99 and 0.01 < y < 0.25"

In auxiliary requests 4a and 4b:
"x is in a range of 0.75 to 0.99; and y is in a range of 0.01 to 0.25"

In auxiliary request 5:
"0.85 < x < 0.99 and 0.01 < y < 0.15"

In auxiliary requests 5a and 5b:
"x is in a range of 0.85 to 0.99; and y is in a range of 0.01 to 0.15"

VII. Independent claim 1 is identical in auxiliary requests 6 and 6a and differs from auxiliary request 3 on account of the following addition, shown underlined:

"... M and Me are each independently at least one element selected from Groups 2 to 14 of the periodic table, wherein M comprises cobalt, ..."

VIII. Independent claim 1 of each of auxiliary requests 7, 7a, 8 and 8a differs from auxiliary request 6 in that the feature "0 < x < 1, and 0 < y < 1" is replaced by the following definitions, respectively:

In auxiliary requests 7 and 7a:
"x is in a range of 0.75 to 0.99; and y is in a range of 0.01 to 0.25"

In auxiliary requests 8 and 8a:
"x is in a range of 0.85 to 0.99; and y is in a range of 0.01 to 0.15"

IX. Independent claim 1 is identical in auxiliary requests 9 and 9a and reads as follows, with deletions in comparison with the main request being shown by strikethrough and additions underlined:

"1. A composite positive electrode active material ~~comprising:~~,
wherein the composite positive electrode material is a compound represented by Formula 3:

Formula 3

$xLiMO_2 \cdot yLiMe_2O_4$

wherein, in Formula 3 x+y=1, 0 < x < 1, and 0 < y < 1; ~~M and~~ Me ~~are each independently~~ is at least one element selected from Groups 2 to 14 of the periodic table, M is cobalt and
a molar ratio of Li/(M+Me) in the composite is less than 1, wherein the compound represented by Formula 3 includes a first metal oxide that has a layered

structure and is represented by Formula 1; and a second metal oxide that has a spinel structure and is represented by Formula 2,

Formula 1 $LiMO_2$

Formula 2 $LiMe_2O_4$."

X. Independent claim 1 is identical in auxiliary requests 10 and 10a and differs from auxiliary request 9 in that the feature "0 < x < 1, and 0 < y < 1" is replaced by "x is in a range of 0.75 to 0.99; and y is in a range of 0.01 to 0.25".

Auxiliary request 10 includes a dependent claim 6, which reads as follows:

"6. The composite positive electrode active material of any of claims 1-5, wherein the composite positive electrode active material further comprises a coating layer comprising at least one selected from a conductive material, a metal oxide, and an inorganic fluoride."

Auxiliary request 10a differs from auxiliary request 10 in that several dependent claims, including claim 6, have been deleted. After renumbering, this leaves claims 2-6 relating to particular embodiments.

XI. The appellant's (opponent's) arguments, where relevant to the present decision, can be summarised as follows.

The subject-matter of claim 1 of auxiliary request 3 was not novel in view of at least D1. The subject-matter of claim 1 of auxiliary request 5b lacked an inventive step in view of D1 as the closest prior art; this was the only objection against that request. The subject-matter of claim 1 of auxiliary requests 9a and

10a also lacked an inventive step in view of D1; this was the only objection against these two requests.

XII. The respondents' (joint patent proprietors') arguments, where relevant to the present decision, can be summarised as follows.

Auxiliary request 3

D1 disclosed core-shell type particles comprising a core of $LiMnO_4$ wrapped in a shell of $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$. This material did not comprise a compound of Formula 3 but had to be seen as a mixture of two distinct compounds. The claimed compound was a unified chemical entity and had no phase boundaries. There was no evidence available that a compound of Formula 3 was implicitly obtained in the examples of D1.

Auxiliary request 5b

D1 was not suitable as the closest prior art because it was directed to core-shell particles and the skilled person would not deviate from this structure. D3 constituted the closest prior art.

The feature of x being in a range of 0.85 to 0.99 and y being in a range of 0.01 to 0.15 provided a technical effect even when compared with the highest value of x disclosed in D1, namely x=0.8. Table 3 and Figures 5D-5F of the patent in suit demonstrated that a compound in which x=0.85 showed at least a significantly improved capacity retention.

The prior art did not hint at compounds of Formula 3 with x being in the range of 0.85 to 0.99, or at the associated beneficial effect.

Auxiliary requests 9/9a, 10/10a

The feature that M was cobalt led to improved high-voltage stability and reduced deterioration of the discharge capacity, as set out on page 16, lines 12-19 of the application as originally filed (paragraph [0068] of the patent in suit) and as seen by comparing Figure 4A and the graph for Example 21 in Figure 4C. The influence of $LiMeO_4$ could be excluded in this comparison, and the effect due to M being cobalt could also be obtained at a low level of $LiCoO_2$, compared with a similar level of $LiMO_2$.

The prior art did not hint at compounds of Formula 3 with M being cobalt, or at the associated beneficial effect. D1 aimed at reducing the cobalt content due to cost and supply issues, so it taught away from using cobalt. Therefore, an inventive step had to be acknowledged even if the technical problem were merely providing an alternative.

Auxiliary request 10

Dependent claim 6 merely specified an additional coating layer and did not lead to a lack of clarity when seen in conjunction with claim 1.

XIII. The appellant (opponent) requested that the decision under appeal be set aside and that the European patent be revoked.

The respondents (joint patent proprietors) requested that the appeal be dismissed or, alternatively, that the patent be maintained as amended on the basis of one of auxiliary requests 1, 1a, 1b, 2, 2a, 2b, 3, 4, 4a, 4b, 5, 5a, 5b, 6, 6a, 7, 7a, 8, 8a, 9, 9a, 10, 10a, 11 and 11a, of which auxiliary requests 1, 1a, 2, 2a, 4, 4a, 5, 5a and 6-11 were filed with the reply to the appeal and auxiliary requests 1b, 2b, 3, 4b, 5b, and 6a-11a were filed on 5 August 2022.

Reasons for the Decision

Auxiliary request 3

1. Novelty in view of D1

1.1 D1 (reference being made to the human translation D1b) discloses in paragraph [0028] a positive electrode material which is a multicomponent metal oxide represented by the chemical formula $(1-x)[Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2]-x[LiMn_2O_4]$, where x is 0.2-0.6, having a microscale layered-spinel composite structure, in which the spinel lithium manganate particles are wrapped by the layered particles of the ternary nickel-cobalt-manganese positive electrode material. This multicomponent metal oxide has neither a layered nor a spinel structure, but a layered-spinel composite structure (paragraph [0056]; paragraph [0057], line 27).

1.2 There was agreement that this material known from D1 included a first metal oxide in accordance with Formula 1 and a second metal oxide in accordance with Formula 2. It was under debate whether it constituted a

"compound of Formula 3" within the meaning of claim 1 at issue.

1.3 According to the respondents, the "compound of Formula 3" was a single unified chemical entity and had no clear phase boundaries. They were of the opinion that this excluded the material known from D1, which had a core-shell structure.

1.4 However, this multicomponent metal oxide known from D1 is not only described by a formula in accordance with Formula 3 stipulated in the claim at issue (see point 1.1 above, the formula $0.75[Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2]-0.25[LiMn_2O_4]$ being specifically disclosed (Working Example 1)), but it is also a unified chemical entity in view of its composite structure, which is even described as a *microscale* layered-spinel composite structure (paragraph [0028], line 33) and which in any case is not a mere physical mixture (paragraph [0041], lines 6-22).

1.5 Furthermore, it does not follow from claim 1 at issue that the compound had no phase boundary. On the contrary, the claimed compound includes a first metal oxide having a layered structure and represented by Formula 1 and a second metal oxide having a spinel structure and represented by Formula 2. The claimed compound thus does not have a single uniform structure but includes a layered phase and a spinel phase, so a phase boundary must also be present. The question of the extent to which the distribution of the two phases - which according to the claim are imperatively present - may be uniform is a matter of degree. Referring to the claimed material as a "compound" does not imply any specific degree of uniformity or any additional feature relating to its structure.

1.6 There is consequently no basis on which the claimed compound could be clearly distinguished from the multicomponent metal oxide having a composite structure known from D1.

1.7 Furthermore, even if the co-precipitation method used in the examples of the patent in suit may lead to a particularly uniform compound, this is not a feature of the claim at issue. The preparation process used in D1 is consistent with the general teaching of the patent in suit on how to obtain the claimed compound represented by Formula 3.

1.8 The known method of D1 involves preparing a nickel-cobalt-manganese composite hydroxide with a shell-core structure (paragraphs [0041]-[0047]), uniformly mixing it with a lithium compound, e.g. lithium carbonate, and sintering the mixture at 850 to 900°C (e.g. for 12 hours in Working Example 1; paragraphs [0048] and [0055]). The composite including a layered phase and a spinel phase forms during this step, with lithium being included in both phases.

This mixing with the lithium compound and sintering corresponds to the mixing and heat-treating step disclosed in the patent in suit (Examples 1 and 9; paragraphs [0090]-[0092]).

The precursor subjected to this mixing and sintering step in D1 (namely a nickel-cobalt-manganese composite hydroxide with a shell-core structure) is different from that used in the examples of the patent in suit (namely a co-precipitate). However, as also taught in the patent, the "M" and "Me" precursor used for mixing with the lithium compound is not limited to a specific

co-precipitate. A precursor obtained by heat-treating a mixture of solid "M" and "Me" precursor compounds may even be used as an alternative (paragraphs [0084] and [0104]-[0111]). There is no reason to question this explicit teaching in the patent in suit related to obtaining a composite positive electrode material represented by Formula 3 (paragraph [0112]). There is consequently no need for supplementary experimental evidence.

It follows that the nickel-cobalt-manganese composite hydroxide with a shell-core structure known from D1 is also suitable. In this composite hydroxide, the metal components naturally have close physical proximity, considering that $Mn(OH)_2$ formed in a first precipitation step serves as a nucleation agent to synthesise a ternary $(Ni_{1/3}Co_{1/3}Mn_{1/3})(OH)_2$ by co-precipitation so that the $Mn(OH)_2$ particles formed in the first step are gradually wrapped by $(Ni_{1/3}Co_{1/3}Mn_{1/3})(OH)_2$ in the second step (paragraph [0011]). The reaction in the subsequent sintering step is therefore facilitated at least in the same manner as in a mere mixture of solid "M" and "Me" precursor compounds.

1.9 Comparing the preparation method used in D1 with the teaching in the patent in suit thus further supports the conclusion that a compound within the meaning of the claim at issue is obtained.

1.10 The subject-matter of claim 1 consequently lacks novelty in view of D1.

Auxiliary request 5b

2. Novelty

2.1 No objection of lack of novelty was raised. The subject-matter of claim 1 differs from D1 on account of the ranges relating to x and y.

3. Inventive step

3.1 The impugned patent relates to a composite positive electrode active material.

3.2 D1 relates to a positive electrode material with a layered-spinel composite structure and thus to the same general purpose. D1 is considered to represent the closest prior art.

3.3 Document D3, which the respondents consider to be the closest prior art, is less relevant because it relates to a mixture of distinct spinel and layered metal oxide components which, in theory, can be separated by physical means (column 9, lines 9-26; claim 1).

3.4 The patent in suit addresses the technical problem of providing excellent lifespan and capacity characteristics (paragraph [0003]). This is similar to the object of D1, which aims at providing good capacity and cycle performance at low cost (paragraphs [0007], [0031] and [0057]).

3.5 According to the respondents, the technical effect associated with the feature of x being in the range of 0.85 to 0.99 and y being in the range of 0.01 to 0.15, compared with x being 0.8, was at least a significantly

improved capacity retention, as could be taken from Table 3 and Figures 5D-5F.

3.6 However, when defining the objective technical problem, an effect cannot be retained if it is not credible that the promised result is attainable throughout the entire range covered by a claim (Case Law of the Boards of Appeal of the EPO, 10th edition, 2022, I.D.4.1). In this case, the indicated technical effect is not consistently obtained. While Table 3 shows an improved capacity retention when Examples 22 and 24 are compared (x=0.8 and x=0.85, respectively), it also shows that no improvement is obtained when Examples 22 and 21 are compared (x=0.8 and x=0.9, respectively).

3.7 In light of the above, the objective technical problem needs to be reformulated in a less ambitious manner, and is merely that of providing an alternative.

3.8 There are no doubts that the technical problem of providing an alternative is solved by the composite electrode material of claim 1, which is a compound represented by Formula 3 with x+y=1 and x being in the range of 0.85 to 0.99 and y being in the range of 0.01 to 0.15.

3.9 It is already known from D1 that a range of proportions of both phases is possible; it is taught that the capacity of the positive electrode material can be adjusted according to the ratio of the layered $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ and the spinel structure $LiMn_2O_4$. The greater the amount of the layered $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$, the higher the capacity of the material (paragraph [0029]). While the product claim in D1 is limited to a range of 0.2-0.6 for the spinel phase (corresponding to y in the impugned patent),

there is no such limitation in the corresponding method claims of D1; the method is said to be highly adaptable to the ratio of the two structures, i.e. the layered structure and the spinel structure (paragraph [0041]).

3.10 A person skilled in the art seeking to provide an alternative would readily consider higher proportions of the layered phase than the range of up to 0.8 generally disclosed in D1, for instance a proportion of 0.85 or more, particularly given that D1 exemplifies a value close to the upper end of this range (i.e. 0.75 in Working Example 1).

In D1, the layered phase contains cobalt, so increasing its proportion amounts to increasing the cobalt content in the positive electrode material. Even though it is an object of D1 to reduce the cobalt content for cost and availability reasons (paragraphs [0002], [0005], [0007] and [0029] of D1), this would not prevent the skilled person from increasing the value of x in view of the not-very-ambitious objective technical problem, especially considering that the increase is only small and the reasons for reducing the cobalt content do not directly concern the material's suitability as a positive electrode material.

3.11 In conclusion, starting from document D1, the subject-matter of claim 1 does not involve an inventive step.

Main request, auxiliary requests 1, 1a, 1b, 2, 2a, 2b, 4, 4a, 4b, 5, 5a, 6, 6a, 7, 7a, 8, 8a

4. In light of the conclusions reached concerning auxiliary requests 3 and 5b, there was no need to separately discuss the main request or any one of

auxiliary requests 1, 1a, 1b, 2, 2a, 2b, 4, 4a, 4b, 5, 5a, 6, 6a, 7, 7a, 8 and 8a because the same conclusion of lack of novelty or lack of inventive step applied. This was not contested by the parties.

5. Novelty

5.1 The same considerations as set out in view of auxiliary request 3 apply to claim 1 of the main request, which is even broader as the composite positive electrode material is openly defined ("*comprising*").

5.2 They also apply to claim 1 of each of auxiliary requests 1-1b and 4-4b. The only additional feature in comparison with the main request and auxiliary request 3, respectively, is that the ranges of x and y are more narrowly defined. Specifically, claim 1 of auxiliary requests 1 and 4 specifies $0.75 < x < 0.99$ and $0.01 < y < 0.25$; claim 1 of auxiliary requests 1a, 1b, 4a and 4b specifies x being in a range of 0.75 to 0.99 and y being in a range of 0.01 to 0.25. It was not argued that these ranges distinguished the claimed subject-matter from D1. Nor was it contested that the highest value of x disclosed in D1 was x=0.8 (using the denotation of the patent in suit). This corresponds to y=0.2. D1 thus anticipates the claimed ranges of x and y.

5.3 The considerations regarding lack of novelty also apply to claim 1 of auxiliary requests 6, 6a, 7 and 7a. It was not disputed that the metal of the first metal oxide in D1 comprised cobalt, as is clear from its formula $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$.

5.4 The subject-matter of claim 1 of each of the main request and auxiliary requests 1-1b, 4-4b and 6-7a is therefore not novel.

6. Inventive step

6.1 The considerations set out in view of auxiliary request 5b apply to claim 1 of each of auxiliary requests 2, 2a, 2b, 5, 5a, 8 and 8a. In all these requests, the distinguishing features are the ranges of x and y, as was the case in auxiliary request 5b. There were no arguments specific to any of these requests, and no additional distinguishing feature can be identified, bearing in mind that the metal M in D1 comprises cobalt. It makes no difference to the assessment of inventive step whether the specific case of x=0.85 and y=0.15 is excluded (as in auxiliary requests 2 and 5).

The subject-matter of claim 1 of each of auxiliary requests 2, 2a, 2b, 5, 5a, 8 and 8a therefore lacks an inventive step.

Auxiliary requests 9, 9a

7. Inventive step

7.1 As set out above (point 3.), D1 may be regarded as the closest prior art.

7.2 As also indicated above (point 3.4), the patent in suit addresses the technical problem of providing excellent lifespan and capacity characteristics.

7.3 The proposed solution is the composite positive electrode active material according to claim 1, which is a compound represented by Formula 3 in which M is cobalt.

The claimed composite positive electrode active material *is* a compound represented by Formula 3. Even though the compound is additionally said to *include* a first metal oxide that has a layered structure and a second metal oxide that has a spinel structure, the term "includes" in this case cannot be understood as allowing for the presence of additional elements because then the specified formula would no longer be fulfilled. Specifying that M is cobalt thus limits $LiMO_2$ to $LiCoO_2$.

7.4 It is taught that using cobalt as the metal M in $LiMO_2$ contributes to solving the technical problem posed (point 7.2) in that it improves the high-voltage stability and reduces the deterioration of the discharge capacity (paragraph [0061] and Figures 4A and 4C of the patent in suit).

7.5 Figures 4A and 4C show the discharge capacity versus the number of cycles of the compounds $0.9LiCoO_2$-$0.1LiNi_{0.5}Mn_{1.5}O_4$ and $0.9LiNi_{0.5}Co_{0.5}O_2$-$0.1LiNi_{0.5}Mn_{1.5}O_4$, respectively. Examples 21-24 show that the correct formula of the spinel phase is $LiNi_{0.5}Mn_{1.5}O_4$; the labelling of Figure 4C is incorrect in light of these examples. These compounds differ only in that M is cobalt in the first case but a combination of nickel and cobalt in the other case. This consequently allows any difference in discharge capacity characteristics to be attributed to M being cobalt. However, this is distinct from the question of

whether a technical effect is obtained across the whole scope of the claim.

7.6 The technical problem may have to be reformulated, in particular in less ambitious terms, if the combination of features in the claim does not solve this problem over the whole area defined in the claim (Case Law of the Boards of Appeal of the EPO, 10th edition, 2022, I.D.4.4.1). In this case, the single pair of examples on which the respondents rely, where Me=$Ni_{0.5}Mn_{1.5}$, x=0.9 and y=0.1, does not allow a conclusion to be drawn in relation to many of the embodiments claimed, in which the metal Me may be any arbitrary Group 2-14 element or combination of elements and in which $LiMeO_4$ may constitute the major part of the compound (y<1). The data provided in the patent in suit supports the conclusion that the discharging profile of $0.1LiCoO_2$-$0.9LiNi_{0.5}Mn_{1.5}O_4$ is more similar to that of pure $LiNi_{0.5}Mn_{1.5}O_4$ than to that of $LiCoO_2$ (Figure 6K), so the influence of $LiMeO_4$ in the compound cannot be ignored. It is consequently not possible to extrapolate a technical effect associated with M being cobalt in the first metal oxide $LiMO_2$ to compounds of which this first metal oxide $LiCoO_2$ only constitutes a very small proportion (x>0).

7.7 In light of the above, the objective technical problem needs to be formulated in a less ambitious manner and is merely that of providing an alternative.

7.8 D1 aims at replacing $LiCoO_2$, which is a known positive electrode material. A person skilled in the art faced with the problem of merely providing an alternative would thus readily contemplate using only cobalt in the layered structure of the composite known from D1, in particular as cobalt is already one of its elements,

and considering that $LiCoO_2$ is similar to $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$.

As indicated with regard to auxiliary request 5b, the reason why an object of D1 is to reduce the cobalt content is its cost and availability. It does not directly concern the material's suitability as a positive electrode material. A person skilled in the art faced with the not-very-ambitious objective technical problem of providing an alternative would thus not be discouraged from increasing the cobalt content in the layered oxide, especially if the proportion of the layered oxide in the composite electrode material is low.

7.9 For these reasons, the subject-matter of claim 1 (which is the same in auxiliary requests 9 and 9a) does not involve an inventive step.

Auxiliary request 10

8. Article 84 EPC

8.1 Claim 1 stipulates "a composite electrode active material, wherein the composite electrode active material is a compound represented by Formula 3 ...". This is construed as a closed definition, limiting the composite electrode active material to the compound of Formula 3 and excluding additional components. It constitutes an amendment in comparison with the patent as granted.

Dependent claim 6, by contrast, specifies that the composite positive electrode active material further *comprises* a coating layer. This feature is inconsistent

with the composite positive electrode active material *being* a compound represented by Formula 3, even more so as the presence of further Group 2-14 metal oxides is contemplated (claim 7).

The amendment thus results in a lack of clarity.

Auxiliary request 10a

9. Inventive step

9.1 Reference is made to the considerations set out in view of auxiliary requests 9 and 9a (point 7., in particular points 7.1-7.5). Claim 1 at issue differs from these requests in that the ranges of x and y are more narrowly defined. The consideration that the first metal oxide $LiCoO_2$ may only constitute a very small proportion of the claimed compound (point 7.6) no longer applies, and there is no need to reformulate the technical problem.

9.2 The objective technical problem may therefore be considered that of providing improved lifespan and capacity characteristics.

9.3 Starting from D1, the skilled person would find no guidance to replace the layered phase $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ with $LiCoO_2$ in order to solve the technical problem posed, i.e. to obtain an improvement.

9.4 An inventive step may therefore be acknowledged.

9.5 Claims 2-6 directly or indirectly depend on claim 1, so the same conclusion applies.

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 on the basis of auxiliary request 10a filed on 5 August 2022 and a description to be adapted accordingly.

The Registrar: The Chairman:

C. Vodz E. Bendl

Decision electronically authenticated