

NOTE: This disposition is nonprecedential.

**United States Court of Appeals
for the Federal Circuit**

MAXELL, LTD.,
Appellant

v.

AMPEREX TECHNOLOGY LIMITED,
Appellee

2023-2256, 2023-2258

Appeals from the United States Patent and Trademark
Office, Patent Trial and Appeal Board in Nos. IPR2021-
01440, IPR2021-01443.

MAXELL, LTD.,
Appellant

v.

AMPEREX TECHNOLOGY LIMITED,
Appellee

2023-2257

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. IPR2021-01441.

Decided: January 23, 2025

ERIK SHALLMAN, Vinson & Elkins LLP, Austin, TX, argued for appellant. Also represented by CORBIN CESSNA, JEFFREY TA-HWA HAN, HILARY L. PRESTON; ERIC JOSEPH KLEIN, PAIGE HOLLAND WRIGHT, Dallas, TX.

BRADY COX, Alston & Bird LLP, Dallas, TX, argued for appellee. Also represented by KIRK T. BRADLEY, CHRISTOPHER TIMOTHY LAWN DOUGLAS, NICHOLAS CHRISTOPHER MARAIS, Charlotte, NC.

Before LOURIE, REYNA, and CHEN, *Circuit Judges*.

LOURIE, *Circuit Judge*.

Maxell, Ltd. appeals from three decisions of the U.S. Patent Trial and Appeal Board (“the Board”) holding claims 1–5 of U.S. Patent 8,691,446 (“the ’446 patent”), claims 1–5 of U.S. Patent 9,350,019 (“the ’019 patent”), and claims 1–11 of U.S. Patent 9,077,035 (“the ’035 patent”) unpatentable as obvious.¹ *Amperex Tech. Ltd. v. Maxell, Ltd.*, No. IPR2021-01440 (P.T.A.B. Mar. 28, 2023) (“*1440 Decision*”), Appeal No. 23-2256, J.A. 1–42; *Amperex Tech. Ltd.*

¹ Appeal No. 23-2256 (relating to the ’446 patent) and Appeal No. 23-2258 (relating to the ’019 patent) were consolidated for briefing. Appeal No. 23-2257 (relating to the ’035 patent) was briefed separately. Because the issues across the appeals largely overlap, we address all three together.

v. Maxell, Ltd., No. IPR2021-01443 (P.T.A.B. Mar. 28, 2023), Appeal No. 23-2256, J.A. 43–85; *Amperech Tech. Ltd. v. Maxell, Ltd.*, No. IPR2021-01441 (P.T.A.B. Mar. 28, 2023) (“*1441 Decision*”), Appeal No. 23-2257, J.A. 1–44.²

For the following reasons, we *affirm*.

BACKGROUND

Maxell owns the ’446 patent, the ’019 patent, and the ’035 patent, which are each generally directed to rechargeable lithium-ion batteries. The patents seek to address problems associated with basic lithium cobalt oxide (LiCoO₂) electrode materials, such as structural decay, reliability, and gas generation, by incorporating cathode materials that contain at least two lithium-containing transition metal oxides having different average particle sizes. *See, e.g.*, ’446 patent, Abstract. For example, claim 1 of the ’446 patent recites:

1. A nonaqueous secondary battery comprising: a positive electrode having a positive electrode mixture layer, a negative electrode, and a nonaqueous electrolyte,

wherein the positive electrode contains, as an active material, at least two lithium-containing transition metal oxides having different average particle sizes,

wherein said at least two lithium-containing transition metal oxides having different average particle sizes have different compositions of elements between them,

² For simplicity, we cite the *1440 Decision* on issues pertaining to both the ’446 and ’019 patents and the *1441 Decision* on issues pertaining to the ’035 patent.

said lithium-containing transition metal oxide having the smallest average particle size is a lithium-containing transition metal oxide represented by the formula (1):



wherein M^1 represents at least one transition metal element selected from Co, Ni and Mn, M^2 represents Mg and at least one metal element selected from the group consisting of Ti, Zr, Ge, Nb, Al and Sn, M^3 represents an element other than Li, M^1 and M^2 , and x , y , z and v are numbers satisfying the equations respectively: $0.97 \leq x < 1.02$, $0.8 \leq y < 1.02$, $0.002 \leq z \leq 0.05$, and $0 \leq v \leq 0.05$,

the positive electrode mixture layer has a density of at least 3.5 g/cm^3 , and

the nonaqueous electrolyte contains a compound having at least two nitrile groups in the molecule.

Id. col. 28 ll. 35–60.

All three patents recite the limitation that the “lithium-containing transition metal oxide having the smallest average particle size is a lithium-containing transition metal oxide represented by the formula (1): $\text{Li}_x\text{M}^1_y\text{M}^2_z\text{M}^3_v\text{O}_2$.” *See, e.g., id.* col. 28 ll. 44–48. Relevant to these appeals is the identity of M^2 in that formula. Each of the ’446 and ’035 patents claims that M^2 “represents Mg and at least one metal element selected from the group consisting of Ti, Zr, Ge, Nb, Al and Sn.” *Id.* col. 28 ll. 50–52; ’035 patent, col. 29 ll. 33–35. Similarly, the ’019 patent claims that M^2 “represents Mg, or Mg and at least one metal element selected from the group consisting of Ti, Zr, Ge, Nb, Al and Sn.” ’019 patent, col. 28 ll. 54–56. Accordingly, all three patents recite that M^2 can be represented by Mg and Al.

In addition to the cathode material, the patents seek to enhance thermal stability of the battery through the use of additives in the nonaqueous electrolyte. Each of the '446 and '019 patents claims that the electrolyte “contains a compound having at least two nitrile groups in the molecule.” '446 patent, col. 28 ll. 59–60; '019 patent, col. 28 ll. 65–67. The '035 patent claims that the electrolyte “contains a fluorine-containing organic solvent.” '035 patent, col. 29 ll. 53–54.

Amperex Technology Limited (“Amperex”) petitioned for, and the Board instituted, *inter partes* review (“IPR”) of all claims of the '446, '035, and '019 patents. Amperex argued, *inter alia*, that claims 1–5 of the '446 patent and claims 1–5 of the '019 patent are invalid because, at the time of the invention, they would have been obvious over U.S. Patent Application Publication 2006/0257745 (“Choi”)³ in combination with U.S. Patent Application 2005/0208371 (“Kim”), and that claims 1–11 of the '035 patent are invalid because, at the time of the invention, they would have been obvious over Choi in combination with U.S. Patent Application 2004/0197667 (“Noh”).

Choi, which relates to “lithium batteries having high voltage stability, thermal stability and high rate discharge characteristics,” discloses a cathode material for a lithium battery that includes large and small diameter materials. Choi, Abstract, ¶ 2. The small diameter material can have the formula $\text{Li}_x\text{Co}_{1-y-z}\text{Ni}_y\text{M}_z\text{O}_{2-a}\text{X}_a$, where M “is selected from the group consisting of Al, Ni, Mn, Cr, Fe, Mg, Sr, V, rare earth elements and mixtures thereof.” Choi, ¶¶ 31–32. Choi further discloses that the battery includes

³ In each of the '446 and '019 patent IPR, Amperex cited Chinese Patent Application Publication 1822414, the Chinese counterpart to Choi. For simplicity, we cite to the U.S. publication of Choi.

an electrolytic solution that can comprise benzonitrile and acetonitrile, *i.e.*, mononitrile solvents. *Id.* ¶ 61.

Kim relates to improving thermal stability of cathode materials, such as lithium-containing transition metal oxide, through “a protection layer formed by a complex between the surface of a cathode active material and an aliphatic nitrile compound.” Kim, Abstract, ¶ 8. The aliphatic nitrile compound can be succinonitrile, *i.e.*, a dinitrile compound. *Id.* ¶ 32.

Noh relates to improving the discharge and thermal stability of lithium batteries using an electrolyte of “lithium salts, an organic solvent with a high boiling point, and a carbonate-based additive compound having substituents selected from the group consisting of a halogen, a cyano (CN), and a nitro (NO₂).” Noh, Abstract. The carbonate-based additive compound can include, for example, a fluorinated aromatic hydrocarbon, such as fluorobenzene and fluorotoluene. *Id.* ¶ 49.

The Board determined that Amperex had established that a person of ordinary skill in the art “would have been motivated by a desire for increased thermal stability and improved discharged characteristics” to combine Choi with each of Kim and Noh to arrive at the claimed inventions of the challenged patents. *'1440 Decision*, J.A. 10; *'1441 Decision*, J.A. 11. Specifically, the Board found that Amperex had presented undisputed testimony that improving thermal stability is critical to battery safety, and that even Maxell agreed that each of Choi, Kim, and Noh is directed to improving the thermal stability and discharge characteristics of lithium batteries. *'1440 Decision*, J.A. 11; *'1441 Decision*, J.A. 12. The Board further noted the parties' agreement that the references teach different ways of achieving those goals. While Choi teaches improving thermal stability through a composite cathode material having large and small diameter particles, each of Kim and Noh teaches improving thermal stability through electrolytic

additives. '1440 Decision, J.A. 11–12; '1441 Decision, J.A. 12–13. The Board found that, given that Kim and Noh taught cathode materials similar to those of Choi, and that Choi taught electrolyte materials similar to those of Kim and Noh, a person of ordinary skill in the art would have been motivated to combine the improved electrolytes of Kim and Noh with the improved cathode materials of Choi, and done so with a reasonable expectation of success. '1440 Decision, J.A. 12–22; '1441 Decision, J.A. 13–24.

Having found that Amperex satisfied its burden of establishing a motivation to combine the references, the Board turned to its obviousness analysis. The only dispute between the parties relevant here was whether a person of ordinary skill in the art would have selected Mg and Al from Choi in the claimed amount to arrive at the claimed inventions. See '1440 Decision, J.A. 22; '1441 Decision, J.A. 25. The Board found that undisputed evidence, including unrebutted expert testimony, which was corroborated with various secondary references, established that a person of ordinary skill in the art would have been motivated to incorporate Mg and Al into a cathode to impart conductivity and structural enhancements, respectively. '1440 Decision, J.A. 24–29; '1441 Decision, J.A. 27–32. In light of that unrebutted evidence, the Board rejected Maxell's arguments that Mg and Al are just one of 600 possible pairs of elements that could have been selected from Choi such that Amperex must have improperly relied on hindsight to arrive at that combination. '1440 Decision, J.A. 27–28; '1441 Decision, J.A. 30–31.

The Board further found that Amperex had established by preponderant evidence that *Choi* teaches a molar amount of M^z , *i.e.*, $0 \leq z \leq 0.5$, that encompasses the claimed range, *i.e.*, $0.002 \leq z \leq 0.05$, therefore establishing a *prima facie* case of obviousness for that limitation. '1440 Decision, J.A. 29–30; '1441 Decision, J.A. 32–33. Moreover, the Board found that undisputed evidence established that the molar amount of M^z would have been understood to be a

result-effective variable that a person of ordinary skill in the art would have been motivated and capable of optimizing through routine experimentation. *'1440 Decision*, J.A. 30–35 (citing expert testimony and supporting secondary references); *'1441 Decision*, J.A. 33–38 (same).

Finding that a preponderance of evidence established that a person of ordinary skill in the art would have arrived at a cathode material that falls within the scope of the claims, the Board held that Amperex had met its burden in showing that the claims would have been obvious over the asserted prior art. Accordingly, the Board held all claims unpatentable under 35 U.S.C. § 103.

Maxell timely appealed. We have jurisdiction under 28 U.S.C. § 1295(a)(4)(A).

DISCUSSION

Maxell raises two arguments on appeal. First, it argues that the Board's motivation-to-combine analyses were not supported by substantial evidence because, *inter alia*, a generic goal to improve thermal stability of a battery is not enough to induce one of ordinary skill to combine Choi with each of Kim and Noh when the references undisputedly teach different ways of achieving that goal. Second, it argues that, even if there had been a motivation to combine the references, the Board's obviousness analyses were not supported by substantial evidence because selecting Mg and Al in the claimed amounts from Choi to arrive at the claimed invention would have been akin to selecting the "proverbial needle in the haystack." *See* Appeal No. 23-2256, Oral Arg. at 3:53–4:12, *available at* https://oralarguments.cafc.uscourts.gov/default.aspx?fl=23-2256_01072025.mp3. We disagree and address each argument in turn.

I

Substantial evidence supports the Board's findings that a person of ordinary skill in the art would have been

motivated to combine Choi with each of Kim and Noh to arrive at a lithium battery having improved thermal stability and discharge characteristics. In reaching that determination, the Board relied on the express teachings of the references and the undisputed testimony of Amperex's expert witness, as well as the corroboration of that testimony by various supporting references. *See, e.g., '1440 Decision*, J.A. 10–22.

Maxell's primary argument on this issue is that "a general expectation of further improvement is not a sufficient basis for a motivation to combine." Reply Br. 5.⁴ Specifically, it is Maxell's position that a person of ordinary skill in the art would not have been motivated to combine Choi with Kim and Noh "because Choi already sufficiently addresses the problems that Kim [and Noh] seek[] to solve: thermal stability and discharge characteristics." Maxell Br. 34. This argument is unpersuasive. While we generally agree that, without more, the mere motivation to "build something better" may not always be enough to combine various references, that is not the case here. *See id.* at 37 (citing *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1328 (Fed. Cir. 2012)).

In contrast with *ActiveVideo*, where there was no relation of the alleged motivation "to any specific combination of prior art elements," 694 F.3d at 1328, the Board thoroughly explained, relying on expert testimony, how Amperex had established that a person of ordinary skill in the art would have combined the specific cathode material of Choi, which was designed to improve thermal stability of the battery, with the specific electrolyte of Kim and Noh, which too were designed to improve thermal stability. *See '1440 Decision*, J.A. 11–20. The Board therefore did not

⁴ Unless otherwise indicated, references to the briefing are to those filed in connection with Appeal No. 23-2256.

rely on the mere fact that the references were each generally directed to improving thermal stability.

Moreover, Maxell's argument that the fact that the references use different means to solve the same problem would have disincentivized combination misses the mark. Under the circumstances of this case, it is the very fact that the references teach different means that would have led a person of ordinary skill in the art to combine them. As Amperex's expert explained:

A person of ordinary skill [would] seek out a cathode that would provide as much [thermal stability] as possible But a person of ordinary skill would also have understood that the electrolyte is an important part of the battery, and that inclusion of a proper electrolyte to impart properties of the battery that would enhance . . . thermal resistance to temperature excursions would [be desired]. So [the person of ordinary skill in the art] would have sought out Choi and Kim [and Noh] as a combination to achieve the desired battery with the desired characteristics.

'1440 *Decision*, J.A. 19. In other words, the fact that the references teach discrete means to achieve the same goal in batteries that are otherwise very similar is entirely consistent with a motivation to combine because each of the cathode material of Choi and electrolyte of Kim or Noh, independently, would have been expected to increase thermal stability.

Accordingly, we conclude that the Board's motivation-to-combine findings were supported by substantial evidence.

II

Maxell next argues that, even if a person of ordinary skill in the art would have combined Choi with each of Kim

and Noh, the Board did not support its obviousness determination with substantial evidence. Again, we disagree.

Maxell's argument is essentially that Choi discloses numerous options for the M² component of its cathode material such that arriving at the selection of Mg and Al, which falls within the scope of the challenged claims, would be akin to finding a needle in a haystack. This argument, however, ignores the fact that Maxell does not specifically claim that needle, *i.e.*, a cathode material wherein M² is Mg and Al. Rather, the challenged claims recite a haystack of their own, in which Mg and Al are just one possible combination. *See, e.g.*, '446 patent, col. 28 ll. 50–52. Maxell's arguments therefore lack persuasion insofar as this case does not involve the patentability of a claim to a species where the prior art discloses only a genus encompassing that species. *Cf. In re Baird*, 16 F.3d 380, 382 (Fed. Cir. 1994) (“The fact that a claimed compound may be encompassed by a disclosed generic formula does not by itself render that compound obvious.”).

We conclude that substantial evidence otherwise supports the Board's obviousness determination. The Board relied on ample evidence to explain why a person of ordinary skill in the art would have been specifically motivated to select Mg and Al from Choi. In particular, the Board relied not only on expert testimony, but explained how that testimony itself was supported by the disclosures of additional literary references, such as Tukamoto⁵ (teaching that Mg doping of a lithium cobalt oxide cathode can significantly increase conductivity), Madhavi⁶ (teaching that

⁵ H. Tukamoto & A.R. West, *Electronic Conductivity of LiCoO₂ and Its Enhancement by Magnesium Doping*, 144 J. ELECTROCHEM. SOC'Y 3164 (1997), J.A. 2913–18.

⁶ S. Madhavi et al., *Cathodic properties of (Al, Mg) co-doped LiNi_{0.7}Co_{0.3}O₂*, 152 SOLID STATE IONICS 199 (2002), J.A. 2926–32.

Mg and Al doping of a lithium cobalt oxide cathode improves thermal stability), and Sato⁷ (claiming a lithium cobalt oxide cathode material comprising at least one of Mg and Al). Those disclosures, pre-dating the priority date of the challenged claims and teaching the specific selection of Al and Mg—a selection that Maxell does not dispute falls within the scope of the challenged claims—constitutes substantial evidence supporting the Board’s determination that it would have been obvious to arrive at the claimed cathode materials.

Maxell further challenges the Board’s treatment of the claimed amount of the M² component, arguing that Choi’s range, *i.e.*, $0 \leq z \leq 0.5$, is so broad, encompassing a very large number of distinct compositions, such that it cannot render obvious the claimed range of $0.002 \leq z \leq 0.05$. We disagree. Choi’s range entirely encompasses the claimed range. “[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a *prima facie* case of obviousness.” *In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003). And here, Maxell provides no argument as to why the claimed range is critical or otherwise meaningfully different from that of Choi. *Cf. Genentech, Inc. v. Hospira, Inc.*, 946 F.3d 1333, 1341 (Fed. Cir. 2020) (noting that one way to rebut obviousness of an overlapping range is to show “that there is something special or critical about the claimed range.” (citation omitted)). Instead, Maxell argues that, for the claimed range to overlap with the prior art, a person of ordinary skill in the art would first have to particularly select Al and Mg from the materials disclosed in Choi, and only then select a molar concentration within the claimed range, falling on the lower end of Choi’s range. But because we have already concluded that substantial evidence supports a motivation to particularly select Mg and Al from Choi, we are unmoved

⁷ U.S. Patent Application Publication 2005/0266315.

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by Maxell's argument on this issue. And, in any event, the Board found, based on testimony and documentary sources, that the lower end of Choi's range had particularly desirable features. *'1440 Decision*, J.A. 30–34.

CONCLUSIONS

We have considered Maxell's remaining arguments and find them unpersuasive. For the foregoing reasons, the Board's decisions holding claims 1–5 of the '446 patent, claims 1–5 of the '019 patent, and claims 1–11 of the '035 patent invalid as obvious are *affirmed*.

AFFIRMED