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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* NORIKAZU KAJIYAMA and TADASHI NAKAMURA

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Appeal 2019-003081
Application 14/646,914
Technology Center 1700

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Before CATHERINE Q. TIMM, KAREN M. HASTINGS, and WHITNEY N. WILSON, *Administrative Patent Judges.*

TIMM, *Administrative Patent Judge.*

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's decision to reject claims 1, 2, and 4–11. *See* Final Act. 1. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Denso Corporation and Kabushiki Kaisha Toyota Chuo Kenkyusho, corporations of Japan. Appeal Br. 3.

## CLAIMED SUBJECT MATTER

The claims are directed to an electrode for use in a gas sensor (*see, e.g.*, claim 1) and a gas sensor element using the same (*see, e.g.*, claim 11). Figure 2 shows a cross-section of a gas sensor element 1 having electrodes 12 and 13. Spec. ¶ 44. As shown in the cross-section of electrode 12 depicted in Figures 3–5, the electrodes include noble metal part 121 and electrolyte part 122. Spec. ¶ 45. Noble metal part 121 is made of noble metal (e.g., platinum) and solid electrolyte part 122 is made of solid electrolyte (e.g., yttria-stabilized zirconia (YSZ)). *Id.* Mixture part 123, where the noble metal and the solid electrolyte are mixed together and in contact with each other in a nano-scale structure, resides along interface part 120 between noble metal part 121 and solid electrolyte part 122. Spec. ¶ 47. Figure 6 depicts mixture part 123 as residing in between lines C1 and C2. Spec. ¶ 51. Claim 1, reproduced below with reference numerals from Figures 1–5, is illustrative of the claimed subject matter:

> 1. An electrode [12, 13] for use in a gas sensor [2] equipped with a gas sensor element [1] capable of detecting a concentration of a specific gas contained in a measuring target gas, the electrode [12, 13] being formed on a first solid electrolyte body [11] having an oxygen ion conductivity arranged in the gas sensor element [1],
>
> the electrode [12, 13] comprising noble metal and second solid electrolyte, wherein
>
> a noble metal part [121], a solid electrolyte part [122] of the second solid electrolyte, and a mixture part [123] are formed in a cross-sectional surface of the electrode [12, 13],
>
> the noble metal part [121] is made of the noble metal,
>
> the solid electrolyte part [122] is made of the second solid electrolyte,

> the mixture part [123] is made of the noble metal and the second solid electrolyte, in which the noble metal and the second solid electrolyte are mixed in contact with each other in a three-dimensional nano-scale structure, and the mixture part [123] is formed along an interface part [120] between the noble metal part [121] and the solid electrolyte part [122], and
>
> when a cross-sectional surface of the mixture part [123] is observed, the noble metal and the second solid electrolyte within the cross-sectional surface of the mixture part are not divided from each other by a single continuous curve inside a circle area having a diameter of 200 nm.

Appeal Br. 18 (Claims Appendix).

## REFERENCES

The prior art relied upon by the Examiner is:

| **Name** | **Reference** | **Date** |
|---|---|---|
| Tanaka | US 5,716,507 | Feb. 10, 1998 |
| Sahimi | US 2005/0016848 A1 | Jan. 27, 2005 |
| Suzuki | US 2007/0095662 A1 | May 3, 2007 |
| Goto | US 2009/0050481 A1 | Feb. 26, 2009 |

## REJECTIONS

The Examiner maintains the following rejections:

Claims 1, 2, and 4–11 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. Ans. 17.

Claims 1, 2, 4–7, and 9–11 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Tanaka, as evidenced by Goto. Final Act. 2.

Claim 8 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Tanaka in view of Sahimi. Final Act. 10.

Claims 1, 2, 5, 7, and 11 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Suzuki. Final Act. 11.

Claim 8 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Suzuki in view of Sahimi. Final Act. 15.

## OPINION

*Indefiniteness*

The Examiner rejects claims 1, 2, and 4–11 as indefinite based on unclear recitations in claim 1. Ans. 17–18.

First, the Examiner determines the recitations "a solid electrolyte part of the second solid electrolyte" and "the solid electrolyte part is made of the second solid electrolyte" conflict with one another. Ans. 17 (emphasis omitted). Specifically, the Examiner states that "[i]t's unclear from this language how the solid electrolyte part can be *a part of* the second solid electrolyte and can also be *made of* the second solid electrolyte." *Id.* (emphasis added).

Appellant contends that "a solid electrolyte part of the second solid electrolyte" means that the solid electrolyte part is a part of the second solid electrolyte and that the "the solid electrolyte part is made of the second solid electrolyte" means the same. Reply Br. 2. But this does not comport with the claim language. Nor is it consistent with the Specification.

Claim 1 recites that the electrode comprises noble metal and second solid electrolyte. Appellant uses "solid electrolyte" to refer to a chemical composition. *See* Spec. ¶ 3 ("yttria-stabilized zirconia [(YSZ)] is a solid electrolyte"). Thus, "solid electrolyte" encompasses chemical compositions such as YSZ.

Claim 1 further recites "a noble metal part, a solid electrolyte part . . . , and a mixture part are formed in a cross-sectional surface of the electrode." Appellant uses "solid electrolyte part" to refer to a structure within the electrode made of the solid electrolyte composition. *See* Spec ¶ 5 ("a solid electrolyte part 922 made of YSZ as solid electrolyte"); Spec. ¶ 47 ("The solid electrolyte part 122 is made of yttria-stabilized zirconia (YSZ)"). Thus, the phrase "of the second solid electrolyte" in the recitation reciting the parts, i.e., "a solid electrolyte part of the second solid electrolyte" is unclear. We sustain the Examiner's rejection of the language.

The Examiner further rejects the further recitation in claim 1 "the mixture part is formed *along an interface part* between the noble metal part and the solid electrolyte part" because Appellant's figures suggest that the mixture part is the interface and it is unclear from the language whether the limitation requires an additional interface or if the claims language is implying that the mixture part 123 is the interface part. Ans. 18.

We determine that the Specification provides guidance that allows the ordinary artisan to understand the meaning of the claim regarding the location of the mixture part along an interface part. Appellant's Specification uses "interface part" to refer to the clear separation between noble metal 921 and solid electrolyte part 922 shown at 920 in Figure 8, which depicts the prior art electrode. Spec. ¶ 5. The Specification explains that dotted line X

within square C of Figure 3 shows the location mixture part 123. Spec. ¶ 48. Mixture part 123 "is continuously formed along the interface part 120." *Id.* The Specification further defines the width of the mixture part 123 as between lines C1 and C2 in Figure 6. Spec. ¶ 51. These two lines, according to the Specification, delineate two interfaces, with C1 delineating the interface between noble part 121 and mixture part 123 and C2 delineating the interface between solid electrolyte part 122 and mixture part 123. *Id.* Thus, the ordinary artisan would interpret "the mixture part is formed along an interface part between the noble metal part and the solid electrolyte part" consistently with the Specification to mean the mixture part runs along the interface part of the prior art.

Thus, we sustain the Examiner's rejection of "a solid electrolyte part of the second solid electrolyte" as indefinite, but we do not sustain the Examiner's indefiniteness rejection of "the mixture part is formed along an interface part between the noble metal part and the solid electrolyte part."

*Obviousness Rejections Based on Tanaka*

The Examiner rejects claims 1, 2, 4–7, and 9–11 as obvious over Tanaka, as evidenced by Goto, and adds Sahimi to reject claim 8. In making these rejections, the Examiner finds that Tanaka's platinum reaction electrode 14 is a noble metal part, Tanaka's solid electrolyte 10 is a solid electrolyte part, and porous film 11 is a mixture part of an electrode. Final Act. 3. The issues for both rejections is the same and can be resolved by considering the rejection of claim 1 as Appellant does not argue the claims separately.

Appellant contends that Tanaka's porous film 11 is not a mixture part of an electrode, rather it is an adhesion layer for reaction electrode 14. Appeal Br. 7–10; Reply Br. 7. Appellant further contends that Tanaka's porous film 11 fails to have nano-scale particles, which are necessary to exclude a continuous curve inside a 200 nm circle as required by claim 1. Appeal Br. 13–16; Reply Br. 8–9.

We disagree with Appellant on both counts.

The Examiner points out that Tanaka's structure has a noble metal part (platinum electrode 14), a solid electrolyte part (zirconia ceramic body 10), and a mixture part (porous film 11 with zirconia particles 12 and platinum particles 13). Ans. 23; Tanaka, col. 4, l. 63–col. 5, l. 13. Although Tanaka does not describe porous film 11 as part of the electrode, the Examiner explains that the difference in semantics does not distinguish Tanaka's porous film 11 from the mixture part of claim 1. As explained by the Examiner:

> The redox reactions that occur in the instant application would inherently occur in the prior art of Tanaka since the same structure is present, made of the same materials (e.g., ceramic solid electrolyte and platinum noble metal). The Appellant's designation of some elements as being the "electrode" while the prior art does not designate the same elements as being the "electrode" does not constitute patentable subject matter. As indicated in the rejection of record and displayed in the annotated Tanaka Fig. 1, Tanaka discloses the same elements and therefore any grouping of such elements could be designated the "electrode" and thus reads on the instant claims.

Ans. 23.

Appellant does not dispute that the porous film 11 of Tanaka carries electric current and allows a redox reaction in the manner of an electrode as

explained by the Examiner. Reply Br. 6–7. Instead, Appellant contends that the ordinary artisan would understand that Tanaka's porous film 11 is an adhesion layer for the reaction electrode. Reply Br. 7. We agree that one reason Tanaka includes the porous film is to increase adhesion. Tanaka, col. 7, ll. 60–67. But that is beside the point. The point is that Tanaka's porous film 11 functions as part of the electrode during use and Appellant has not identified a structural distinction between what is claimed and Tanaka's configuration.

Appellant further contends that Tanaka fails to disclose or suggest a mixture part having nano-scale noble metal particles and nano-scale solid electrolyte particles such that when a cross-sectional surface of the mixture part is observed, the noble metal and the second solid electrolyte within the cross-sectional surface of the mixture part are not divided from each other by a single continuous curve inside a circle area having a diameter of 200 nm. Appeal Br. 13.

The Examiner responds that the claims do not require the particles have nano-scale order diameters and the claims encompass the structure of Tanaka. Ans. 30–31.

The issue is: Has Appellant identified a reversible error in the Examiner's claim interpretation or the finding that Tanaka's structure inherently would have the structure required by claim 1?

Appellant has not identified such an error.

First, we agree with the Examiner's interpretation of the 200 nm circle limitation. Ans. 29–30. As determined by the Examiner, the limitation requires a lack of an abrupt continuous interface inside a 200 nm diameter circle, i.e., the claim excludes the abrupt interface shown in the Examiner's

annotated Figure 7 (Ans. 30 (circle said to be approximately to scale)). Instead, the interface must be a mixture of the particles as shown in the interface of Figure 5 (also reproduced Ans. 30). As further determined by the Examiner, any 200 nm circle lacking a continuously curved interface meets the claim limitation. Ans. 29; Claim 1 ("a circle area"). Appellant does not dispute the Examiner's interpretation. Reply Br. 8–9.

Second, it is reasonable to conclude that at some location Tanaka's porous film 11 would have a cross-sectional surface on which one can find a 200 nm diameter circle in which the noble metal and solid electrolyte are divided by something other than a single continuous curve. As pointed out by the Examiner, Tanaka discloses a mixed interface layer (porous film 11) comprising solid electrolyte particles (12) and noble metal particles (13) where the noble metal particles are of an average diameter in the range of 0.01 μm to 1.0 μm (10 nm to 1000 nm). Ans. 31, citing Tanaka col. 2, ll. 60–64. The metal particles are included in a concentration of 10 wt.% of the porous film. Tanaka, col. 5, ll. 10–12. Metal particles of only 10 nm average diameter interspersed at a concentration of 10 wt.% with particles of solid electrolyte would not be able to form a single continuous curve inside a circle area of 200 nm diameter. The extent of a single continuous curve would be at most the circumference of a 10 nm diameter metal particle, which would necessarily be less than 200 nm. Selecting metal particles within the lower end of Tanaka's size range would have necessarily led to interfaces between the metal particle and solid electrode of less than 200 nm and no single continuous curve inside a circle area having a diameter of 200 nm. The lack of a single continuous curve is a natural result of selecting the smaller metal particle sizes of Tanaka. As such it is inherent. *See Persion*

*Pharm. LLC v. Alvogen Malta Operations Ltd.*, 945 F.3d 1184, 1191 (Fed. Cir. 2019) ("inherency renders a claimed limitation obvious only if the limitation is 'necessarily present,' or is 'the natural result of the combination of elements explicitly disclosed by the prior art.'" (quoting *PAR Pharm., Inc. v. TWI Pharm., Inc.*, 773 F.3d 1186, 1195–96 (Fed. Cir. 2014)).

Given the reasonableness of the conclusion of inherency, the burden shifted to Appellant to present evidence that, in fact, the structure of claim 1 does not occur when following the teachings of Tanaka. *In re Spada*, 911 F.2d 705, 708 (Fed. Cir. 1990); *In re Best*, 562 F.2d 1252, 1255 (CCPA 1977). Appellant has not presented such evidence on this appeal record.

*Obviousness based on Suzuki*

Claims 1, 2, 5, 7, and 11 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Suzuki. The Examiner against adds Sahimi to reject claim 8.

The issues for the rejections based on Suzuki parallel the issues we addressed above. For similar reasons to those expressed above, we determine that Appellant has not identified a reversible error in the Examiner's findings as to the structure of Suzuki's intermediate electrode layer, which the Examiner finds is a mixture part within the meaning of claim 1.

There is no dispute that Suzuki's intermediate electrode layer 21 can include platinum particles 50 and zirconia particles 4. Reply Br. 7; Suzuki, Fig. 6; ¶ 68. Nor is there any dispute that Suzuki's Figure 6 depicts platinum particles 50 as substantially smaller than zirconia particles 4. Reply Br. 7.

Suzuki discloses that platinum particles 50 have a diameter of 10 nm to 1000 nm. Suzuki ¶ 68.

Appellant contends that the ordinary artisan would understand that "the configuration of Suzuki's intermediate layer 21 would not correspond to the recited mixture part, in which the noble metal and the second solid electrolyte are mixed in contact with each other in a three-dimensional nano-scale structure." Reply Br. 7–8. But what the ordinary artisan would understand is not germane to the question. The question is whether it is reasonable to conclude that Suzuki teaches or suggests an intermediate electrode layer 21 inherently having the structure required by claim 1.

Such a conclusion is reasonable. The Examiner finds that "the zirconia particles 4 and platinum particles 50 are necessarily in contact with one another and thus are not separated by one another by any measureable degree." Final Act. 13; Suzuki, Fig. 6. Given that Suzuki teaches using platinum particles 50 of 10 nm to 1000 nm diameter (Suzuki ¶¶ 68–69), it is reasonable to conclude that the platinum noble metal and the zirconia solid electrolyte are not divided from each other by a single continuous curve inside a circle area having a diameter of 200 nm when selecting platinum particles of the smaller diameters of Suzuki's 10 nm to 1000 nm range. This is so because the circle can be located anywhere on the cross-sectional surface, and platinum particles with small diameters, such as less than 60 nm, would result in interfaces between the small platinum particles and zirconia particles smaller than the diameter of at least one 200 nm circle.

Under the circumstances, the burden shifted to Appellant to show that selecting the smaller platinum particles of Suzuki would not necessarily result in the division of noble metal and solid electrolyte recited in claim 1.

Appellant has not provided persuasive evidence overcoming the Examiner's inherency finding.

## CONCLUSION

The Examiner's decision to reject claims 1, 2, and 4–11 is AFFIRMED.

## DECISION SUMMARY

| **Claim(s)** | **35 U.S.C. §** | **Basis/Reference(s)** | **Affirmed** | **Reversed** |
|---|---|---|---|---|
| 1, 2, 4–11 | 112 | Indefiniteness | 1, 2, 4–11 | |
| 1, 2, 4–7, 9–11 | 103(a) | Tanaka, Goto | 1, 2, 4–7, 9–11 | |
| 8 | 103(a) | Tanaka, Sahimi | 8 | |
| 1, 2, 5, 7, 11 | 103(a) | Suzuki | 1, 2, 5, 7, 11 | |
| 8 | 103(a) | Suzuki, Sahimi | 8 | |
| **Overall Outcome** | | | 1, 2, 4–11 | |

## TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED