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| HUSCH BLACKWELL LLP<br>HUSCH BLACKWELL SANDERS LLP WELSH & KATZ<br>120 S RIVERSIDE PLAZA<br>22ND FLOOR<br>CHICAGO, IL 60606 |             |                      | BOHATY, ANDREW K    |                  |
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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* HIDEKO INOUE and TOMOYA YAMAGUCHI

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Appeal 2020-000091  
Application 14/867,535  
Technology Center 1700

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BEFORE BEVERLY A. FRANKLIN, JEFFREY B. ROBERTSON, and  
JAMES C. HOUSEL, *Administrative Patent Judges*.

ROBERTSON, *Administrative Patent Judge*.

DECISION ON APPEAL<sup>1</sup>

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<sup>1</sup> This Decision includes citations to the following documents: Specification filed September 28, 2015 (“Spec.”); Final Office Action mailed January 25, 2019 (“Final Act.”); Appeal Brief filed May 30, 2019 (“Appeal Br.”); Examiner’s Answer mailed August 8, 2019 (“Ans.”); and Reply Brief filed October 3, 2019 (“Reply Br.”).

## STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant<sup>2</sup> appeals from the Examiner's decision to reject claims 1, 3–12, and 14–31.<sup>3</sup> Appeal Br. 10. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

## CLAIMED SUBJECT MATTER

Appellant states the invention relates to an organometallic complex, as well as a light-emitting element, a light-emitting device, electronic device, and a lighting device including the organometallic complex. Spec. ¶ 1. Claim 1 is representative of the claims on appeal and reproduced below (Appeal Br., Claims Appendix 23):

1. An organometallic complex comprising:
  - a metal belonging to Group 9 or 10; and
  - a ligand,
    - wherein the ligand comprises a benzofuro[2,3-b]pyridine skeleton or a benzothieno[2,3-b]pyridine skeleton, and a pyrimidine ring,
      - wherein carbon at the 2-position of the benzofuro[2,3-b]pyridine skeleton or the benzothieno[2,3-b]pyridine skeleton is bonded to the metal,
      - wherein nitrogen at the 3-position of the pyrimidine ring is bonded to the metal,
      - wherein carbon at the 3-position of the benzofuro[2,3-b]pyridine skeleton or the benzothieno[2,3-b]pyridine skeleton is bonded to carbon at the 4-position of the pyrimidine ring,
      - wherein carbon at the 6-position of the pyrimidine ring is bonded to an alkyl group or an aryl group, and

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<sup>2</sup> We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42(a). Appellant identifies Semiconductor Energy Laboratory Co., Ltd., as the real party in interest. Appeal Br. 4.

<sup>3</sup> Claims 2 and 13 have been canceled. *See* Appeal Br. 4.

wherein the alkyl group is a substituted or unsubstituted alkyl group having 4 to 10 carbon atoms.

Claims 12 and 23 are also independent and recite organometallic complexes having structures recited therein. *Id.* at 25–26, 29.

## REFERENCES

The prior art relied upon by the Examiner is:

| Name                                    | Reference          | Date             |
|---|--------------------|------------------|
| Kwong et al.<br>hereinafter “Kwong”     | US 2008/0261076 A1 | October 23, 2008 |
| Alleyne et al.<br>hereinafter “Alleyne” | US 2010/0090591 A1 | April 15, 2010   |
| Seo et al.<br>hereinafter “Seo”         | US 2012/0274201 A1 | November 1, 2012 |
| Beers et al.<br>hereinafter “Beers”     | US 2014/0131663 A1 | May 15, 2014     |

## REJECTIONS

1. The Examiner rejected claims 1, 3–12, 14–23, and 26–31 under 35 U.S.C. § 103 as unpatentable over Seo and Beers. Final Act. 5–6.
2. The Examiner rejected claims 24 and 25 under 35 U.S.C. § 103 as unpatentable over Seo, Beers, Kwong, and Alleyne. Final Act. 6–7.

## OPINION

### *Rejection 1*

Appellant does not present separate arguments with respect to the claims subject to this rejection. *See* Appeal Br. 10–21. Thus, we select

claim 1 as representative for disposition of this rejection. 37 C.F.R.  
§ 41.37(c)(1)(iv).

*The Examiner's Rejection*

In rejecting claim 1 as unpatentable over Seo and Beers, the Examiner found Seo discloses electroluminescent devices comprising a phosphorescent dopant that contains an iridium metal organometallic complex including an aryl containing pyrimidine ligand such as a phenyl pyrimidine ligand, but Seo does not disclose the phenyl (aryl) group may be an azadibenzofuran or a dibenzothiophene. Final Act. 5. The Examiner found Beers discloses ligands for iridium metal complexes used as phosphorescent dopants including an azadibenzofuran group containing ligand, where Beers discloses the azadibenzofuran group may be used to slightly red shift the emission color of the dopant. *Id.* at 6, citing Beers ¶¶ 54, 55, 63, 80–82. The Examiner determined it would have been obvious to have modified the compound dopants of Seo to change the phenyl group in Seo to an azadibenzofuran or a dibenzothiophene group to red shift the emission color of the dopant. *Id.*

*Appellant's contentions*

Appellant contends Beers does not disclose a pyrimidine ring in the compounds disclosed therein. Appeal Br. 13–14. As such, Appellant contends there is an insufficient showing as to how the compounds disclosed in Beers would be relevant to the claimed invention, which requires a pyrimidine ring. *Id.* at 15. Appellant argues claim 1 requires the carbon at the 2-position of the benzofuro[2,3-b]pyridine skeleton or the

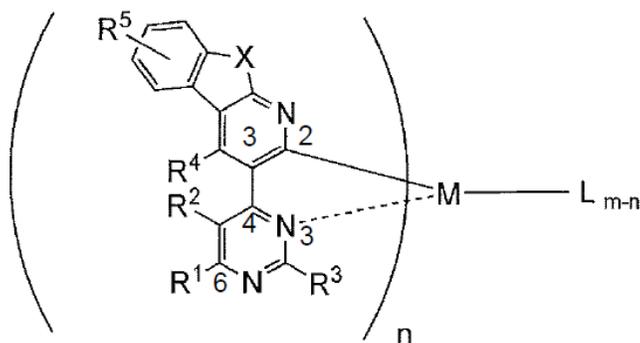
benzothieno[2,3-b]pyridine skeleton is bonded to the metal, whereas in Beers, the bond to the metal is in a different position and not adjacent to the nitrogen atom. *Id.* at 15–16. Appellant argues there has been no showing that the different compounds will act the same as the claimed ligand and no evidence that the claimed ligand will red shift. *Id.* at 16. Appellant contends that the Specification discusses that when the atom adjacent to the carbon atom bonded to the metal is an electron withdrawing nitrogen atom, which is not present in the compounds shown in Table 1 of Beers, the emission wavelength is short, which is contrary to red shifting that makes the emission wavelength long. *Id.* at 17–21, citing Spec. ¶ 76. Appellant contends the claimed invention achieves unexpected results, such as high emission efficiency, high color purity, low power consumption, and high reliability. *Id.*, citing Spec. ¶¶ 76, 116–117.

#### *Issue*

Has Appellant demonstrated reversible error in the Examiner's position that an organometallic complex as recited in claim 1 would have been obvious in view of Seo and Beers?

#### *Discussion*

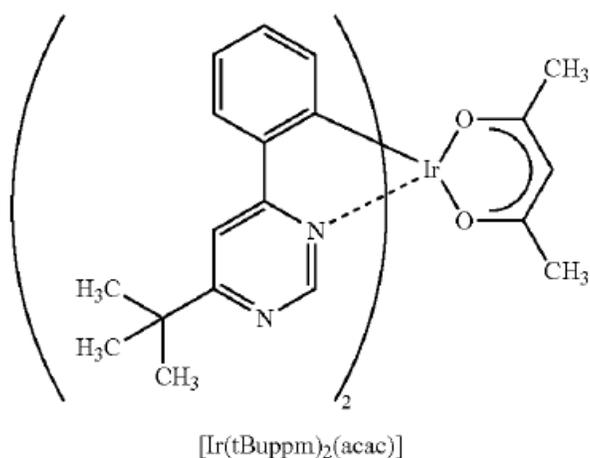
We are not persuaded by Appellant's arguments. A general formula for the organometallic complexes falling within the complexes recited in claim 1 is reproduced below (with annotations to show atom numbering consistent with claim 1) from Appellant's Specification (¶ 16; *see also* claim 12):



(G1)

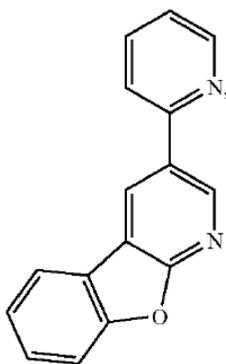
General Formula G1 is an organometallic complex where L represents a monoanionic ligand, R<sup>1</sup> is a substituted or unsubstituted alkyl group having 4 to 10 carbon atoms or a substituted or unsubstituted aryl group having 6 to 13 carbon atoms; each of R<sup>2</sup> to R<sup>5</sup> independently represents hydrogen, a substituted or unsubstituted alkyl group having 1 to 6 carbon atoms, or a substituted or unsubstituted phenyl group; the organometallic complex is monosubstituted, disubstituted, trisubstituted, tetrasubstituted, or unsubstituted by the R<sup>5</sup>; X represents O or S; and M represents a metal belonging to Group 9 or 10. When M represents a metal belonging to Group 9, m is 3 and n is 1, 2, or 3. When M represents a metal belonging to Group 10, m is 2 and n is 1 or 2. Spec. ¶¶ 16, 17.

As found by the Examiner, Seo discloses a phosphorescent organometallic iridium (Group 9) complex including a pyrimidine ring. Seo ¶ 89. As an example, Seo discloses (acetylacetonato)bis(6-tert-butyl-4-phenylpyrimidinato)iridium(III) ([Ir(tBuppm)<sub>2</sub>(acac)]), the structure of which (Structure 105) is reproduced below (Seo ¶ 279):



The structure of Ir(tBuppm)(acac) reproduced above depicts an organometallic complex wherein as recited in claim 1, the nitrogen at the 3-position of the pyrimidine ring is bonded to the metal and wherein the carbon at the 6-position of the pyrimidine ring includes an alkyl group (t-butyl) that has four carbon atoms. However, in contrast to claim 1, rather than the 4-position of the pyrimidine ring being bonded to a carbon at the 3-position of a benzofuro[2,3-b]pyridine skeleton or a benzothieno[2,3-b]pyridine skeleton, the 4-position of the pyrimidine ring is bonded to a phenyl group, and a carbon of the phenyl group is bonded to the metal.

Beers discloses that in iridium pyridine complexes where it was already known that substituting a dibenzofuran for a phenyl group (both bonded to the metal via a carbon atom (*see* Beers ¶ 55, Table 1) resulted in a slight red shift in emission, introducing an azadibenzofuran (benzofuro[2,3-b]pyridine skeleton) substitution provides further red shifting. Beers ¶ 55. In particular, and as identified by the Examiner (Final Act. 6; Ans. 9), Beers discloses an example of such a ligand (L<sub>A107</sub>), reproduced below (Beers ¶ 63, p. 38):



The azadibenzofuran containing ligand disclosed in Beers and reproduced above depicts a benzofuro[2,3-b]pyridine group as recited in claim 1, wherein the carbon at the 3-position of the benzofuro[2,3-b]pyridine group is bonded to a pyridine ring. In this regard, Appellant's annotated drawings of one ligand in Beers having a different structure than the ligand in Beers relied on by the Examiner to indicate different attachment points relative to the claimed ligand (Appeal Br. 16) are not persuasive, as Appellant does not address the ligand in Beers relied upon by the Examiner.

Accordingly, we are not persuaded by Appellant's argument that the azadibenzofuran group of Beers, when substituted for the phenyl group in Seo, would bond to the metal at a different attachment point, as the modified ligand would have the same structure as recited in claim 1, and thus would have been expected to bond to the metal at the same positions. *In re Fitzgerald*, 619 F.2d 67, 70 (CCPA 1980) (“[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his claimed product. . . . Whether the rejection is based on ‘inherency’ under 35 U.S.C. s [sic] 102, on ‘prima facie obviousness’ under 35 U.S.C. s [sic] 103, jointly or alternatively, the burden of proof is the same . . . (footnote omitted).”) (quoting *In re Best*, 562 F.2d 1252, 1255 (CCPA 1977)).

Thus, although Appellant emphasizes that Beers discloses a pyridine ring rather than a pyrimidine ring as recited in claim 1, we are of the view that one of ordinary skill in the art would have had a reasonable expectation of success in substituting the phenyl group of Seo with the azadibenzofuran (benzofuro[2,3-b]pyridine) group disclosed in Beers, because Beers expressly discloses it is this substitution that provides further red shifting, without attributing the effect of the benzofuro[2,3-b]pyridine group to the pyridine ring. *See* Ans. 10. As stated by the Supreme Court in *KSR*, “any need or problem known in the field of endeavor at the time of [the] invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 420 (2007). *KSR* instructs that “familiar items may have obvious uses beyond their primary purposes.” *Id.* at 420–421. Accordingly, we are of the view that the Examiner’s rationale is sufficiently supported and does not rely on improper hindsight.

Moreover, Appellant’s contention that Seo’s disclosure shows a light emitting element that has an emission wavelength peak at 548 nm and the Specification shows a light emitting element with an emission peak at 519 nm, which represents a blue shift when moving from a phenyl group to azadibenzofuran or dibenzothiophene as in claim 1 (Appeal Br. 18–20), is not persuasive. In addition to not addressing the specific ligand of Beers relied upon by the Examiner, as the Examiner points out, the alkyl groups on the pyrimidine ligand are different. *See* Ans. 12. Thus, Appellant does not

provide a direct comparison and therefore, such a comparison is insufficient to support Appellant's argument.<sup>4</sup>

In this regard, we are not persuaded by Appellant's argument that Beers discloses the ligands provide blue shifting rather than red shifting. As the Examiner points out, Beers discloses such blue shifting occurs when azadibenzofuran ligands are compared to dibenzofuran ligands. Beers ¶ 55; Ans. 11. Indeed, Beers discloses that the azadibenzofuran ligands are still red-shifted when compared to phenyl pyridine iridium complexes (*id.*, Table 1) such that as the Examiner explained, depending on the desired wavelength, one of ordinary skill in the art would have adjusted the emission wavelength of the compound. *See* Ans. 12–13.

We are also not persuaded by Appellant's argument that the Examiner's rationale is contrary to the object and result of the claimed invention. That is, none of the claims recite emitting green phosphorescence as argued by Appellant. Appeal Br. 17. In this case, the reasoning behind the Examiner's rejection need not be the same as Appellant's. It is not necessary that the prior art suggest the combination for the same reason as contemplated by Appellant. *In re Kahn*, 441 F.3d 977, 987 (Fed. Cir. 2006).

Moreover, we agree with the Examiner that with respect to the present claims providing unexpected results, Appellant has not provided sufficient evidence that the alleged high emission efficiency, high color purity, low power consumption, and high reliability properties, which are not recited in

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<sup>4</sup> As a result of this discussion, we find it unnecessary to address the Examiner's position that the method used to measure the emission spectra are different as well as the propriety of the Examiner's further reliance on Bazan et al. (US 2004/0142206 A1) in the Answer for support. Ans. 12; *see* Appeal Br. 20; Reply Br. 7–8.

the claims, would have been unexpected. Ans. 11. That is, although the Specification discusses the effect of the electron withdrawing nitrogen group adjacent to the carbon atom bonded to the metal in the azadibenzofuran group (Spec. ¶¶ 76, 116, 117), we have not been directed to sufficient evidence that this effect would have been an unexpected.

Accordingly, we affirm the Examiner's rejection of claims 1, 3–12, 14–23, and 26–31 as obvious over Seo and Beers.

### *Rejection 2*

Appellant does not set forth separate arguments with respect to claims 24 and 25, the subject of Rejection 2, but rather appears to rely on the dependency of these claims as a basis for patentability. Accordingly, we affirm the Examiner's rejection of claims 24 and 25 for similar reasons as discussed above with respect to claim 1.

## DECISION SUMMARY

In summary:

| <b>Claims Rejected</b> | <b>35 U.S.C. §</b> | <b>Reference(s)/Basis</b>  | <b>Affirmed</b>       | <b>Reversed</b> |
|------------------------|--------------------|----------------------------|-----------------------|-----------------|
| 1, 3–12, 14–23, 26–31  | 103                | Seo, Beers                 | 1, 3–12, 14–23, 26–31 |                 |
| 24, 25                 | 103                | Seo, Beers, Kwong, Alleyne | 24, 25                |                 |
| <b>Overall Outcome</b> |                    |                            | 1, 3–12, 14–31        |                 |

Appeal 2020-000091  
Application 14/867,535

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