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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* DEBASISH BANERJEE, SONGTAO WU, KHOA VO, and  
ALBERTO ARGOITIA

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Appeal 2018-006753  
Application 14/607,933  
Technology Center 2800

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Before KAREN M. HASTINGS, JAMES C. HOUSEL, and  
JEFFREY R. SNAY, *Administrative Patent Judges*.

SNAY, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant<sup>1</sup> appeals from the Examiner's decision rejecting claims 1–3, and 5–20. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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<sup>1</sup> We use the word Appellant to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies Toyota Jidosha Kabushiki Kaisha and Viavi Solutions, Inc. as the real parties in interest. Appeal Br. 2.

## BACKGROUND

The invention relates to multilayer stack structures which exhibit little or no noticeable color shift when viewed from different angles. Spec. ¶ 2.

Claim 1 reads as follows:

1. A hybrid omnidirectional structural color pigment comprising:
  - a multilayer stack having:
    - a reflector core layer;
    - a dry deposited high index of refraction ( $n_h$ ) dielectric layer extending across said reflective core layer, said dry deposited  $n_h$  dielectric layer having a *thickness between 0.1-2.0 quarter wave thickness* for a desired control wavelength;
    - a dry deposited absorber layer extending across said dry deposited  $n_h$  dielectric layer, said reflector core layer, dry deposited  $n_h$  dielectric layer and dry deposited absorber layer being planar layers; and
    - a wet deposited  $n_h$  outer oxide layer extending across said dry deposited absorber layer;
  - said multilayer stack having a reflection band with a predetermined *full width at half maximum (FWHM) of less than 200 nm* and a predetermined color hue shift of less than  $30^\circ$  when said multilayer stack is exposed to broadband electromagnetic radiation and viewed from angles between  $0$  and  $45^\circ$  relative to normal of an outside surface of said multilayer stack.

Appeal Br. 30 (Claims Appendix) (emphasis added to highlight disputed recitations). Claim 14 recites a method for making a structural color pigment that essentially meets the characteristics recited in claim 1. Each remaining claim on appeal depends from claim 1 or 14.

## REJECTIONS<sup>2</sup>

- I. Claims 1–3 and 5–20 stand rejected under 35 U.S.C. § 103 as unpatentable over Bradley,<sup>3</sup> Raksha,<sup>4</sup> and Argoitia.<sup>5</sup>
- II. Claims 1–3 and 5–20 stand rejected under 35 U.S.C. § 103 as unpatentable over Argoitia and Bradley.

## OPINION

### *Rejection I: obviousness over Bradley in view of Raksha, and Argoitia*

With regard to Rejection I, Appellant argues the claims as a group. *See* Appeal Br. 15–18; Reply Br. 2–10. We select claim 1 as representative of the group. Each of claims 2, 3, and 5–20 stands or falls with claim 1.

Relevant to Appellant’s arguments on appeal, the Examiner finds Bradley discloses a multilayer interference film which exhibits a single magenta color that is independent of viewing angle. Final Act. 4 (citing Bradley 10:20–62). The Examiner finds that Bradley discloses the same layer materials and thicknesses as are described in the Specification as suitable for exhibiting a color within the visible spectrum at a full width at half maximum (FWHM) of less than 200 nm. *Id.* The Examiner also finds that Argoitia provides a reason to provide Bradley’s dielectric layer at a thickness of 1.0 to 2.0 quarter waves (QW) in order to provide non-shifting color for dielectric materials having a refractive index greater than 2.0. *Id.* at 5–6.

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<sup>2</sup> Rejections under 35 U.S.C. § 112 and nonstatutory double patenting are withdrawn. Ans. 2–3.

<sup>3</sup> US 6,157,489, issued December 5, 2000.

<sup>4</sup> US 7,169,472 B2, issued January 30, 2007.

<sup>5</sup> US 2003/0190473 A1, published October 9, 2003.

Appellant argues the Examiner’s finding that Bradley’s structure would have exhibited color at a FWHM less than 200 nm is not supported by evidence. Appeal Br. 13–15; Reply Br. 3–5. Particularly, Appellant contends only spectral colors within the visible spectrum necessarily exhibit a FWHM less than 200 nm, and that such spectral colors can only be produced by emitting sources, not by reflecting white light. *Id.* at 14. Appellant argues certain colors, such as silver, gold, and copper, have broad reflection spectra. *Id.* at 14–15.

Appellant’s arguments are not persuasive of reversible error. The Examiner finds, and Appellant does not dispute, that Bradley’s multilayer structure exhibits a *single* color. *Compare* Final Act. 4 (“Bradley et al teaches explicitly that the multilayer stack having this multilayer interference structure can be **non**-shifting single color.”), *with* Appeal Br. 13–15). The Examiner’s finding is supported by Bradley’s disclosures that the relied-upon example presents only magenta. Bradley 10:31–32 (“The formed interference film had nonshifting magenta-to-magenta color properties.”). Appellant’s argument that silver, gold, and copper have broader reflection spectra does not address the Examiner’s finding with regard to Bradley’s disclosure of magenta.<sup>6</sup> Moreover, Appellant does not challenge the Examiner’s finding (Final Act. 4) that Bradley’s disclosed structure includes “identical layer materials and layer thickness[es] as the instant application,” such that it would reasonably have been expected to have the same reflection properties, including a FWHM value of less than

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<sup>6</sup> Appellant identifies magenta as an achromatic color (Appeal Br. 14), but presents neither evidence nor argument regarding magenta’s reflection spectrum.

200 nm. As such, Appellant has advanced no compelling rationale why the Examiner's conclusion is not reasonable. *Cf. In re Spada*, 911 F.2d 705, 708 (Fed. Cir. 1990) (when a claimed product reasonably appears to be substantially the same as a product disclosed by the prior art, the burden is on the applicant to prove the prior art product does not necessarily or inherently possess characteristics attributed to the claimed product); *In re Best*, 562 F.2d 1252, 1255 (CCPA 1977).

Appellant also contends Bradley teaches a dielectric having 4.0 quarter wave thickness, rather than the 0.1–2.0 quarter wave thickness recited in claim 1. Appeal Br. 16; Reply Br. 8–10. Appellant argues Argoitia does not suggest a lower dielectric thickness because Argoitia provides diffractive structures in combination with dielectric layers. *Id.* at 16–17.

Appellant's arguments are not persuasive. The Examiner relies on Argoitia as evidence that one skilled in the art would have known that achieving non-shifting vs. shifting color in a multilayer structure “can be controlled” by adjusting the thickness of the dielectric layer. Ans. 13; *see also* Argoitia ¶ 57 (“The structural differences between interference non-shifting and color shifting multi-layer structures . . . are typically characterized by differences in the thickness and refractive index of dielectric materials within the multilayer structures.”). Argoitia specifies that “[a] dielectric material with an index of refraction of about 2 or greater having an optical thickness with a low number of quarter waves (i.e., about 1–2 QW), typically results in a low color shift or no color shift at all.” *Id.* Argoitia's teaching that added diffractive structures can impart additional color effects, *id.* ¶ 17 (“The present invention brings together diffractive

effects in combination with thin film interference effects technology to create new color effects hitherto not seen before.”), does not negate the relied-upon disclosure that a non-shifting color may be achieved by adjusting dielectric thickness, such as providing a 1–2 QW thickness dielectric having a refractive index of 2 or greater.<sup>7</sup>

The Examiner’s Rejection I is sustained.

*Rejection II: obviousness over Argoitia in view of Bradley*

With regard to Rejection II, which relies on the same teachings in Argoitia and Bradley as are discussed above, Appellant argues Argoitia’s layers having surface diffractive structures are not “planar” as is recited in claim 1. However, the Examiner’s rejection relies on the combined teachings of Argoitia and Bradley, where Bradley provides a reason to form planar layers in a multilayer interference structure. *See* Final Act. 13 (citing Bradley as evidence of a reason to use “the multilayer stack structure taught

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<sup>7</sup> We note that Bradley also appears to meet the recited dielectric thickness. Claim 1 recites a dielectric layer “having a thickness between 0.1–2.0 quarter wave thickness for a desired control wavelength.” The Specification defines “quarter wave thickness” as “one-quarter of the desired control wavelength, i.e.  $QW = \lambda_{cw}/4$  where  $\lambda_{cw}$  is the desired control wavelength.” Spec. 26–27. Thus, for a 506 nm control wavelength, claim 1 would require a dielectric layer thickness in the range of  $(0.1–2.0) \cdot (506 \text{ nm}/4)$  or 12.7–253 nm. Bradley provides a dielectric of ZnS having an optical thickness of 4 QWOT at 506 nm. Bradley 10:23–26. Bradley defines QWOT as “ $4 \eta d/\lambda$ ” where  $\eta$  is the refractive index of the layer,  $d$  is the physical thickness of the layer, and  $\lambda$  is the wavelength at which a QWOT condition occurs (*id.* at 4:53–59). Thus, for Bradley’s disclosed optical thickness of 4 QWOT, the layer’s physical thickness  $d$  would be defined by  $\lambda/\eta$ . Bradley’s ZnS dielectric has a refractive index of 2.2. *Id.* at 5:10. Applying Bradley’s definition of QWOT, the disclosed dielectric layer would have a thickness  $d$  of  $506 \text{ nm}/2.2$  or 230 nm, which is within the range of 12.7–253 nm.

by Argoitia et al to make a non-color shifting multilayer stack without the diffractive structure”). Appellant’s argument against Argoitia alone does not demonstrate error in the Examiner’s determination based on the combined teachings of Argoitia and Bradley. Accordingly, Rejection II also is sustained.

### CONCLUSION

The Examiner’s decision rejecting claims 1–3 and 5–20 is affirmed.

### 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, 5–20	103(a)	Bradley, Raksha, Argoitia	1–3, 5–20	
1–3, 5–20	103(a)	Argoitia, Bradley	1–3, 5–20	
<b>Overall Outcome</b>			1–3, 5–20	

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

AFFIRMED