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Armstrong Teasdale LLP (12764) 7700 Forsyth Blvd. Suite 1800 St. Louis, MO 63105			COLLISTER, ELIZABETH A	
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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* VORAMON SUPATARAWANICH DHEERADHADA,  
DON MARK LIPKIN, and AKANE SUZUKI

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Appeal 2019-006587  
Application 15/138,286  
Technology Center 1700

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Before TERRY J. OWENS, N. WHITNEY WILSON, and  
BRIAN D. RANGE, *Administrative Patent Judges*.

OWENS, *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 to reject claims 1, 2, 5, 6, 8, 9, and 11–15. 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(a). Appellant identifies the real party in interest as General Electric Company. Appeal Br. 1.

CLAIMED SUBJECT MATTER

The claims are directed to THREE PHASE BOND COATING SYSTEM FOR SUPERALLOYS. Claim 1, reproduced below, is illustrative of the claimed subject matter:

A coating system on a substrate comprising:

a nickel-based superalloy substrate, wherein the nickel-based superalloy substrate comprises:

- 3 –20 wt % cobalt;
- 2 –22 wt % chromium;
- 0 –4 wt % molybdenum;
- 0 –10 wt % tungsten;
- 0– 6 wt % rhenium;
- 2 –8 wt % aluminum;
- 0–10 wt % tantalum;
- 0 –2 wt % hafnium;
- 0– 5 wt % niobium;
- 0 –4 wt % titanium;
- 0 –5 wt % ruthenium; and
- a remainder of nickel; and

a nickel-based coating composition disposed on the substrate, the coating composition comprising:

- 2–12 wt % cobalt;
- 4– 8 wt % chromium;
- 8–25 wt % aluminum;
- 5–10 wt % tantalum; and
- 35–81 wt % nickel,

at least 95 volume % of said coating composition comprising a three phase  $\gamma$ ,  $\gamma'$ ,  $\beta$  microstructure, wherein

- 5–35 volume % of the coating composition is present in the  $\gamma$  phase;
- 25–70 volume % of the coating composition is present in the  $\gamma'$  phase;

and

- 5–60 volume % of the coating composition is present in the  $\beta$  phase

## REFERENCES

The prior art relied upon by the Examiner is:

Name	Reference	Date
Litton	US 2009/0035601 A1	Feb. 5, 2009
Harada (herein Sato)	EP 2 110 449 A1	Oct. 21, 2009

## REJECTION

Claims 1, 2, 5, 6, 8, 9, and 11–15 stand rejected under 35 U.S.C. § 103 over Litton in view of Sato.

## OPINION

The Appellant indicates that claims 2, 5, 6, 8, 9, and 11–15 stand or fall with claim 1 (Appeal Br. 6). We therefore limit our discussion to claim 1.

Litton forms coatings on components exposed to high temperatures, such as turbine blades, a protective coating (composition 4–8 wt% aluminum, 10–14 wt% cobalt, 8–12 wt% chromium, up to 1 wt% hafnium, up to 2 wt% molybdenum, up to 2 wt% rhenium, up to 1 wt% silicon, 3–6 wt% tungsten, 3–6 wt% tantalum, up to 1 wt% yttrium, up to 60 wt% platinum, about 0.001–2 wt% zirconium, and a balance of nickel, and having 10–30 vol%  $\gamma$  phase, 10–60 vol%  $\gamma'$  phase, and 10–60 vol%  $\beta$  phase) (Paras. 17, 20, 21).

Sato coats a turbine blade Ni-based alloy substrate (composition 8 wt% Co, 7 wt% Cr, 2 wt% Mo, 5 wt% W, 6.2 wt% Al, 7 wt% Ta, 0.2 wt% Hf, 3 wt% Re) with a protective coating (composition: 6.1 wt% Co, 4 wt% Cr, 1 wt% Mo, 4.6 wt% W, 8.3 wt% Al, 9.7 wt% Ta, 0.3 wt% Hf, and 0.5 wt% Y) (Tables 7 (Rene N5), 8 (Coating M), 9 (Ex 34)).

All of Litton's coating composition component ranges overlap the Appellant's claim 1's corresponding ranges, and all of Sato's substrate composition component ranges are within the Appellant's claim 1's corresponding ranges. Hence, the Appellant's coating and substrate compositions would have been *prima facie* obvious to one of ordinary skill in the art over Litton's coating composition and Sato's substrate composition. *See In re Peterson*, 315 F.3d 1325, 1329–30 (Fed. Cir. 2003):

In cases involving overlapping ranges, we and our predecessor court have consistently held that even a slight overlap in range establishes a *prima facie* case of obviousness . . . .

. . . .

Selecting a narrow range from *within* a somewhat broader range disclosed in a prior art reference is no less obvious than identifying a range that simply *overlaps* a disclosed range. In fact, when as here, the claimed ranges are completely encompassed by the prior art, the conclusion is even more compelling than in cases of mere overlap. [(Citations omitted.)]

Establishing a *prima facie* case of obviousness requires showing that one of ordinary skill in the art would have had both an apparent reason or suggestion to modify the prior art and predictability or a reasonable expectation of success in doing so. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007); *In re Vaeck*, 947 F.2d 488, 493 (Fed. Cir. 1991). “Obviousness does not require absolute predictability of success . . . . For obviousness under § 103, all that is required is a reasonable expectation of success.” *In re O'Farrell*, 853 F.2d 894, 903–04 (Fed. Cir. 1988).

Litton's disclosure that the coating is an Ni-base alloy containing cobalt, chromium, aluminum, tantalum, and tungsten for protecting an underlying component exposed to high temperatures such as a turbine blade

Appeal 2019-006587  
Application 15/138,286

(Paras. 3, 5, 6), and Sato's disclosure that the substrate is a heat resistant member at temperatures of 1000 °C or higher such as a turbine blade and is coated with a protective Ni-base alloy containing cobalt, chromium, aluminum, tantalum and tungsten (Paras. 2, 7), would have provided one of ordinary skill in the art with an apparent reason to use Litton's coating to protect Sato's substrate. Litton's disclosure that the coating has  $\gamma$ ,  $\gamma'$ , and  $\beta$  phases and inhibits diffusion such that it is compatible with an underlying substrate (Paras. 3–5, 18, 21), and Sato's disclosure that the coating/substrate combination inhibits interdiffusion of elements at the substrate/coating interface (Abstract), would have provided such a person with a reasonable expectation of success in doing so.

The Appellant argues that one of ordinary skill in the art would recognize the relationship between the composition of the substrate and the phases present in the coating composition in facilitating compatibility between the substrate and the coating, and that because Sato discloses elemental diffusion at an interface between a nickel-based superalloy and a coating material when there is a chemical potential difference between them, and exemplifies a combination of a three-phase microstructure coating only with a Ni-base alloy substrate composition that is not Rene N5 (Table 4, Coating 15), Sato would not have provided one of ordinary skill in the art with a reasonable expectation of success in forming a compatible combination of a three-phase microstructure coating and a Rene N5 substrate (Appeal Br. 4–5; Reply Br. 1–2).

Sato is not limited to its examples. *See In re Fracalossi*, 681 F.2d 792, 794 n.1 (CCPA 1982); *In re Mills*, 470 F.2d 649, 651 (CCPA 1972). Instead, all disclosures therein must be evaluated for what they would have fairly suggested to one of ordinary skill in the art. *See In re Boe*, 355 F.2d

961, 965 (CCPA 1966). When Sato coated Rene N5 with Coating M, almost no modified layer was observed at the coating/substrate interface, indicating diffusion inhibition at that interface (Paras. 48, 52; Table 8; Table 9, Ex. 34). Thus, Sato's disclosure that diffusion-inhibiting thermodynamic equilibrium is achieved when 1) the coating layer includes at least one of the  $\gamma$ ,  $\gamma'$ , and  $\beta$  phases, and/or 2) formation of a diffusion-modified layer is suppressed at the interface between the coating and the substrate (Para. 16),<sup>2</sup> would have provided one of ordinary skill in the art with a reasonable expectation of success in obtaining diffusion-inhibiting thermodynamic equilibrium by coating Rene N5 with either Coating M or Litton's coating composition containing  $\gamma$ ,  $\gamma'$ , and  $\beta$  phases (Litton Para. 21).

The Appellant, therefore, has not indicated reversible error in the Examiner's rejection. Accordingly, we affirm the rejection.

### CONCLUSION

The Examiner's rejection 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, 2, 5, 6, 8, 9, 11-15	103	Litton, Sato	1, 2, 5, 6, 8, 9, 11-15	

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<sup>2</sup> Sato discloses that thermodynamic equilibrium corresponds to a state of theoretically equal chemical potential (Para. 11).

Appeal 2019-006587  
Application 15/138,286

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