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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, MINJUAN ZHANG, and  
TAKUJI KITA

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Appeal 2018-007294  
Application 13/117,286  
Technology Center 1700

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Before JEFFREY B. ROBERTSON, JEFFREY R. SNAY, and  
BRIAN D. RANGE, *Administrative Patent Judges*.

SNAY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant<sup>1</sup> appeals under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1–3 and 6–9. We have jurisdiction under 35 U.S.C. § 6(b).

We reverse.

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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 Toyota Motor Engineering & Manufacturing North America, Inc. and Toyota Motor Corporation as the real parties in interest. Appeal Br. 2.

## BACKGROUND

The subject matter on appeal relates to the manufacture of thermoelectric materials. Spec. ¶¶ 1, 10. Claim 1 is the sole independent claim:

1. A process for manufacturing a thermoelectric material having a plurality of grains and grain boundaries, the process comprising:
  - determining a material composition to be investigated for the thermoelectric material;
  - providing a range of values of matrix grain size between 5 and 100 nanometers (nm) and a range of values of matrix grain boundary barrier height between 10 and 300 milli-electron volts (meV);
  - calculating a plurality of Seebeck coefficients, electrical resistivity values and thermal conductivity values for the material composition as a function of the range of values of matrix grain size between 5 and 100 nm and the range of values of grain boundary barrier height between 10 and 300 meV;
  - calculating a range of figure of merit values for the material composition as a function of the calculated Seebeck coefficients, calculated electrical resistivity values and calculated thermal conductivity values, the calculated range of figure of merit values being a function of the range of values of matrix grain size between 5 and 100 nm and the range of values of matrix grain boundary barrier height between 10 and 300 meV;
  - selecting a figure of merit value from the calculated range of figure of merit values, the selected figure of merit value corresponding to a value of matrix grain size between 5 and 100 nm and a value of matrix grain boundary barrier height between 10 and 300 meV;
  - providing powders having the investigated material composition, the powders having a mean diameter less than or generally equal to the value of matrix grain size that corresponds to the selected figure of merit value; and
  - consolidating the powders and manufacturing a thermoelectric material having the investigated material

composition, a matrix grain size generally equal to the value of matrix grain size that corresponds to the selected figure of merit and a matrix grain boundary barrier height generally equal to the value of matrix grain boundary barrier height that corresponds to the selected figure of merit.

## REJECTIONS<sup>2</sup>

- I. Claims 1–3 and 6–9 stand rejected under 35 U.S.C. § 101 as being directed to patent-ineligible subject matter.
- II. Claims 1–3 and 6–9 stand rejected under 35 U.S.C. § 112, first paragraph, for lack of adequate written description.
- III. Claims 1–3 and 6–9 stand rejected under 35 U.S.C. § 112, first paragraph, for lack of enablement.
- IV. Claims 1–3 and 6 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Murai.<sup>3</sup>
- V. Claims 7–9 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Murai and Kucherov.<sup>4</sup>

## DISCUSSION

### *Rejection I: subject matter eligibility*

The Examiner rejects claims 1–3 and 6–9 under 35 U.S.C. § 101 as being directed to a judicial exception—namely, an abstract idea without significantly more. Ans. 3–5. Appellant argues that the recited steps regarding providing and consolidating specified powders to form a

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<sup>2</sup> The Examiner’s rejection under 35 U.S.C. § 101 is set forth in the Answer as a new ground. Ans. 3–4. Prior rejections under 35 U.S.C. §§ 102 and 112, second paragraph, are withdrawn. *Id.* at 5.

<sup>3</sup> Murai et al., WO 2010/041146 A2, published Apr. 15, 2010.

<sup>4</sup> Kucherov et al., US 2003/0033818 A1, published Feb. 20, 2003.

thermoelectric material ensures that the claim as a whole is directed to a patent-eligible physical process and not an abstract idea. Appeal Br. 12. Having considered the Examiner’s findings and Appellant’s arguments, we are persuaded the Examiner reversibly erred in rejecting Appellant’s claims under 35 U.S.C. § 101.

#### A. Section 101

An invention is patent-eligible if it claims a “new and useful process, machine, manufacture, or composition of matter.” 35 U.S.C. § 101. However, the U.S. Supreme Court has long interpreted 35 U.S.C. § 101 to include implicit exceptions: “[l]aws of nature, natural phenomena, and abstract ideas” are not patentable. *E.g.*, *Alice Corp. v. CLS Bank Int’l*, 573 U.S. 208, 216 (2014).

In determining whether a claim falls within an excluded category, we are guided by the Court’s two-part framework, described in *Mayo* and *Alice*. *Alice*, 573 U.S. at 217–18 (citing *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 75–77 (2012)). In accordance with that framework, we first determine what concept the claim is “directed to.” *See Alice*, 573 U.S. at 219 (“On their face, the claims before us are drawn to the concept of intermediated settlement, *i.e.*, the use of a third party to mitigate settlement risk.”); *see also Bilski v. Kappos*, 561 U.S. 593, 611 (2010) (“Claims 1 and 4 in petitioners’ application explain the basic concept of hedging, or protecting against risk.”).

Concepts determined to be abstract ideas, and thus patent ineligible, include certain methods of organizing human activity, such as fundamental economic practices (*Alice*, 573 U.S. at 219–20; *Bilski*, 561 U.S. at 611); mathematical formulas (*Parker v. Flook*, 437 U.S. 584, 594–95 (1978)); and

mental processes (*Gottschalk v. Benson*, 409 U.S. 63, 67 (1972)). Concepts determined to be patent eligible include physical and chemical processes, such as “molding rubber products” (*Diamond v. Diehr*, 450 U.S. 175, 191 (1981)); “tanning, dyeing, making waterproof cloth, vulcanizing India rubber, smelting ores” (*id.* at 182 n.7 (quoting *Corning v. Burden*, 56 U.S. 252, 267–68 (1853))); and manufacturing flour (*Benson*, 409 U.S. at 69 (citing *Cochrane v. Deener*, 94 U.S. 780, 785 (1876))).

In *Diehr*, the claim at issue recited a mathematical formula, but the Court held that “a claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula.” *Diehr*, 450 U.S. at 187; *see also id.* at 191 (“We view respondents’ claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula.”). Having said that, the Court also indicated that a claim “seeking patent protection for that formula in the abstract . . . is not accorded the protection of our patent laws, and this principle cannot be circumvented by attempting to limit the use of the formula to a particular technological environment.” *Id.* (citation omitted) (citing *Benson* and *Flook*); *see, e.g., id.* at 187 (“It is now commonplace that an *application* of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection.”).

If the claim is “directed to” an abstract idea, we turn to the second part of the *Alice* and *Mayo* framework, where “we must examine the elements of the claim to determine whether it contains an ‘inventive concept’ sufficient to ‘transform’ the claimed abstract idea into a patent-eligible application.” *Alice*, 573 U.S. at 221 (quotation marks omitted). “A claim that recites an abstract idea must include ‘additional features’ to ensure ‘that the [claim] is

more than a drafting effort designed to monopolize the [abstract idea].” *Id.* (alterations in original) (quoting *Mayo*, 566 U.S. at 77). “[M]erely requir[ing] generic computer implementation[] fail[s] to transform that abstract idea into a patent-eligible invention.” *Id.*

#### B. USPTO Section 101 Guidance

In January 2019, the U.S. Patent and Trademark Office (USPTO) published revised guidance on the application of § 101. 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (Jan. 7, 2019) (“2019 Revised Guidance”).<sup>5</sup> “All USPTO personnel are, as a matter of internal agency management, expected to follow the guidance.” *Id.* at 51; *see also* October 2019 Update at 1.

Consistent with the 2019 Revised Guidance and the October 2019 Update, we first look to whether the claim recites:

- (1) any judicial exceptions, including certain groupings of abstract ideas (i.e., mathematical concepts, certain methods of organizing human activity such as a fundamental economic practice, or mental processes) (“Step 2A, Prong One”); and

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<sup>5</sup> In response to received public comments, the Office issued further guidance on October 17, 2019, clarifying the 2019 Revised Guidance. USPTO, *October 2019 Update: Subject Matter Eligibility* (the “October 2019 Update”) (available at [https://www.uspto.gov/sites/default/files/documents/peg\\_oct\\_2019\\_update.pdf](https://www.uspto.gov/sites/default/files/documents/peg_oct_2019_update.pdf)).

(2) additional elements that integrate the judicial exception into a practical application (*see* MPEP § 2106.05(a)–(c), (e)–(h) (9th ed. Rev. 08.2017, Jan. 2018)) (“Step 2A, Prong Two”).<sup>6</sup>

2019 Revised Guidance, 84 Fed. Reg. at 52–55.

Only if a claim (1) recites a judicial exception and (2) does not integrate that exception into a practical application, do we then look, under Step 2B, to whether the claim:

(3) adds a specific limitation beyond the judicial exception that is not “well-understood, routine, conventional” in the field (*see* MPEP § 2106.05(d)); or

(4) simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception.

2019 Revised Guidance, 84 Fed. Reg. at 52–56.

We have considered the Examiner’s findings and the Appellant’s arguments in light of the controlling case-law and Guidance, and we are not persuaded the Examiner erred in rejecting the claims under 35 U.S.C. § 101.

*Guidance Step 2A, Prong 2*

Under Step 2A, Prong 2, of the Guidance, a claim is not directed to ineligible subject matter if elements of the claim integrate a purported

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<sup>6</sup> This evaluation is performed by (a) identifying whether there are any additional elements recited in the claim beyond the judicial exception, and (b) evaluating those additional elements individually and in combination to determine whether the claim as a whole integrates the exception into a practical application. *See* 2019 Revised Guidance - Section III(A)(2), 84 Fed. Reg. 54–55.



exception into a practical application. *See* MPEP § 2106.05(a)–(c), (e)–(h). Appellant argues that the recitations, “providing powders,” and “consolidating the powders and manufacturing a thermoelectric material” integrate any purported abstract idea into a practical application. *See* Appeal Br. 11–13. We agree.

When considering whether the claims are directed to a patent-ineligible concept, “[t]he ‘directed to’ inquiry . . . cannot simply ask whether the claims *involve* a patent-ineligible concept, because essentially every routinely patent-eligible claim involving physical products and actions *involves* a law of nature and/or natural phenomenon.” *See Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1335–36 (citing *Mayo*, 566 U.S. at 70–71). Rather, “the ‘directed to’ inquiry applies a stage-one filter to claims” considered in their entirety, in light of the Specification, to ascertain whether the claims’ character as a whole is directed to excluded subject matter. *Id.* (citing *Internet Patents Corp. v. Active Network, Inc.*, 790 F.3d 1343, 1346 (Fed. Cir. 2015)).

Having reviewed the evidence, we disagree with the Examiner’s determination that the claims are directed to an abstract idea. That characterization of Appellant’s claims disregards the claim language that requires providing specified powders that meet determined criteria and requires consolidating those powders to manufacture a thermoelectric material. Rather, we conclude that the character of the claims as a whole is directed to an improved process for the manufacture of thermoelectric material. The Specification supports our conclusion. *See, e.g.*, Spec. ¶¶ 9–10 (explaining that the described process newly enables manufacture of

thermoelectric materials exhibiting high ZT values based on consideration of grain-related properties).

Because we find the claims integrate any recited mental steps into a practical application involving a physical manufacturing process, and, therefore are not directed to an abstract idea, the Examiner's rejection under 35 U.S.C. § 101 is not sustained.

*Rejection II: written description*

The Examiner finds that the recited ranges of matrix grain size and grain boundary height, the step of calculating Seebeck coefficients, electrical resistivity, and thermal conductivity, and the steps of selecting a figure of merit value, providing powders, and manufacturing a thermoelectric material are not found in the Specification. Final Act. 5–7. The Examiner also finds the Specification does not provide formulas or expressions for the calculation of figure of merit values. *Id.* at 6.

Appellant points to particular passages in the Specification where each of the above-listed elements are described. Appeal Br. 14–19. For example, Appellant points to paragraph 36 which identifies the recited ranges for grains size and barrier height. *Id.* at 14. Appellant also points to paragraphs 40, 42, and 46 which identify mathematical expressions for determination of Seebeck coefficient, electrical resistivity, thermal conductivity, and figure of merit. *Id.* at 17–18.

In response to Appellant's identification of express written support in the Specification, the Examiner appears to focus on figures in the Specification and contends that the recited calculations over the ranges recited in claim 1 are not shown in the figures. Ans. 6–8.

In rejecting a claim under the first paragraph of 35 U.S.C. § 112 for lack of adequate descriptive support, it is incumbent on the Examiner to establish that the originally filed disclosure would not have reasonably conveyed to one having ordinary skill in the art that Appellant had possession of the now claimed subject matter. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). Adequate description under the first paragraphs of 35 U.S.C. § 112 does not require literal support for the claimed invention. *In re Herschler*, 591 F.2d 693, 701 (CCPA 1979); *In re Edwards*, 568 F.2d 1349, 1351–52 (CCPA 1978); *In re Wertheim*, 541 F.2d 257, 262 (CCPA 1976). In addition, the written description requirement does not demand either examples or an actual reduction to practice. *Ariad Pharms.*, 598 F.3d at 1352.

Here, the Examiner does not dispute Appellant's identification passages in the Specification that provide the same language as is recited in claim 1. Rather, the Examiner appears to take issue with whether Appellant's Specification provides examples depicted in the figures that cover the full range of grain-related property values recited in the claim. As noted, neither examples nor an actual reduction to practice is required.

On this record, we are persuaded the Examiner has not met the initial burden of articulating why the claims on appeal are not described in a manner sufficient to convey to one having ordinary skill in the art that Appellant had possession of the now claimed subject matter.

Accordingly, the Examiner's rejection for lack of written description is not sustained.

*Rejection III: enablement*

Enablement is assessed under 35 U.S.C. § 112, which states:

The specification shall contain a written description of the invention, and of the *manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same*, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

35 U.S.C. § 112 (emphasis added).

The burden to prove non-enablement rests with the Examiner:

[t]he [Examiner] bears an initial burden of setting forth a *reasonable explanation as to why it believes that the scope of protection provided by that claim is not adequately enabled by the description of the invention provided in the specification of the application*; this includes, of course, providing sufficient reasons for doubting any assertions in the specification as to the scope of enablement. If the [Examiner] meets this burden, the burden then shifts to the applicant to provide suitable proofs indicating that the specification is indeed enabling.

*In re Wright*, 999 F.2d 1557, 1561–62 (Fed. Cir. 1993) (emphasis added).

The Examiner’s determination of non-enablement is premised on the finding that the Specification “does not reasonably provide enablement for calculating a plurality of Seebeck coefficients, electrical resistivity values and thermal conductivity values.” Final Act. 7. Appellant contends that all of the foregoing calculations are described in paragraphs 40–46 of the Specification. Appeal Br. 20–21. The Examiner responds that “the equations provided in the specification are not enough.” Ans. 9.

Absent sufficient articulated basis for challenging Appellant’s mathematical expressions regarding the recited material properties, the

Examiner's finding that the recited calculations are not enabled is conclusory and insufficient to meet the burden of explaining why the scope of any claim on appeal is not adequately enabled to one of ordinary skill in the art. Accordingly, the Examiner's rejection for lack of enablement is not sustained.

*Rejections IV and V: obviousness*

Each of the Examiner's obviousness determinations is premised on a finding that Murai discloses the same materials as are described in the Specification and, on that basis, any thermoelectric material manufactured from Murai's materials would have exhibited a grain boundary barrier height within the recited range. Final Act. 12, 15. Appellant argues, *inter alia*, that grain boundary barrier height of a thermoelectric material is affected by doping and/or altering a surface of nanoparticles used in manufacturing the material. Appeal Br. 31, citing Spec. ¶ 12. The Examiner similarly acknowledges that grain boundary barrier height can be impacted by more than the compositional makeup, including doping or the formation of barriers in the form of Schottky barriers or semiconductor heterojunction barriers. *See* Final Act. 15. Because the Examiner does not identify any disclosure in Murai regarding conditions, which the Examiner admits would have impacted at least grain boundary barrier height, including doping and surface alteration, we are persuaded that the Examiner's finding of an implicit grain boundary barrier height within the recited range in any thermoelectric material disclosed in Murai is not supported by a preponderance of the evidence.

Accordingly, the Examiner's obviousness rejections are not sustained.

CONCLUSION

The Examiner's decision rejecting claims 1-3 and 6-9 is reversed.

In summary:

<b>Claim(s) Rejected</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/Basis</b>	<b>Affirmed</b>	<b>Reversed</b>
1-3, 6-9	101			1-3, 6-9
1-3, 6-9	112			1-3, 6-9
1-3, 6	103	Murai		1-3, 6
7-9	103	Murai, Kucherov		7-9
<b>Overall Outcome</b>				1-3, 6-9

REVERSED