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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/962,055	10/07/2022	MAHLA POUDINEH	21846	9353

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EXAMINER	
JANG, CHRISTIAN Y	

ART UNIT	PAPER NUMBER
3791	

NOTIFICATION DATE	DELIVERY MODE
09/12/2025	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 17/962,055	Applicant(s) POUDINEH et al.	
	Examiner CHRISTIAN JANG	Art Unit 3791	AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 7/24/25.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-31 is/are pending in the application.

5a) Of the above claim(s) 18-25 and 28-31 is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-17 and 26-27 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Group I, and Species A, comprising claims 1-17 and 26-27 in the reply filed on 7/24/25 is acknowledged.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 11 recites the limitation "the nucleic acid sequence" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention.
>
> (a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

Claim(s) 1-2, 4-6, 8-9, 13-16, 26-27 is/are rejected under 35 U.S.C. 102(a)(1) and (a)(2) as being anticipated by Irvine et al. (US 2020/0377929).

As to claim 1, Irvine teaches a microneedle for detecting a target (Abstract), the microneedle comprising: a hydrogel ([0017]); a probe coupled to the hydrogel ([0017] - peptide nucleic acid probes bound to a hydrogel), the probe for generating a measurable signal in the presence of the target ([0057]).

As to claim 2, Irvine teaches the hydrogel comprises a polymer ([0033]) comprising at least one C=C functionality; an acrylated polymer, a methacrylated polymer, or a combination thereof; and/or methacrylated gelatin, methacrylated hyaluronic acid, methacrylated alginate, methacrylated chitosan, methacrylated collagen, methacrylated polyethylene glycol, methacrylated polyvinyl alcohol, methacrylated polylysine, or a combination thereof ([0059]).

As to claim 4, Irvine teaches the probe coupled to the hydrogel comprises the probe being coupled to the hydrogel by covalent bonding, intermolecular bonding, physisorption, complexation, a linker; or a combination thereof ([0017]).

As to claim 5, Irvine teaches the probe comprises a nucleic acid ([0017] - peptide nucleic acid), wherein the nucleic acid is an nucleic acid that binds to the target ([0044]); and wherein the nucleic acid optionally comprises an aptamer, single stranded complementary probe DNA, peptide nucleic acid, nucleic acid enzyme, or combinations thereof ([0017]).

As to claim 6, Irvine teaches the nucleic acid comprises a linker functional group for coupling the probe to the hydrogel ([0017] - photo-cleavable linker; [0060]).

As to claim 8, Irvine teaches the probe comprises a fluorophore; or an electroactive species, a redox active species, or a combination thereof ([0043-45], [0106-0139]).

As to claim 9, Irvine teaches the probe comprises a nucleic acid, and the nucleic acid comprises a fluorophore or is linked to a fluorophore, or the nucleic acid comprises a redox reporter or is linked to a redox reporter ([0017], [0043-45], [0106-0139]).

As to claim 13, Irvine teaches the measurable signal is fluorescence; or an electrochemical signal ([0043-45], [0106]).

As to claim 14, Irvine teaches the target comprises a biomolecule present in interstitial fluid ([0124]).

As to claim 15, Irvine teaches the target comprises small biomolecules, proteins, or micro ribonucleic acids; or cortisol, vanomycin, gentamicin, tyrosinamide, thrombin, micro-RNA miR21, micro-RNA miR210, uric acid (UA), serotonin, insulin, adenosine triphosphate, or glucose ([0018]).

As to claim 16, Irvine teaches the microneedle has a length of about 300 pm to about 1000 pm, such as about 800 pm ([0142]).

As to claim 26, Irvine teaches an apparatus for detecting a target in a sample (Abstract), the apparatus comprising: the microneedle according to claim 1 (see above); and a detector for detecting the measurable signal (Claim 1).

As to claim 27, Irvine teaches a transdermal patch ([0017]) comprising the microneedle according to claim 1 (see above).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim(s) 3 and 17 is/are rejected under 35 U.S.C. 103 as being unpatentable over Irvine et al. (US 2020/0377929) in view of Cui et al. (US 2009/0005667).

As to claim 3, Irvine does not explicitly teach that the hydrogel further comprises a conductive polymer, an ionomer, or a combination thereof; or poly(3,4-ethylenedioxythiophene) polystyrene sulfonate; polyacetylene; polypyrrole; polyindole; polyaniline; a copolymer thereof; or a combination thereof. Cui teaches a hydrogel to be used in combination with an electrode system ([0099]) in which the hydrogel comprises polymers such as polypyrrole and PEDOT (i.e. poly(3,4-ethylenedioxythiophene)) to improve the electrical characteristics of the hydrogel, as well as incorporating conductive polymer within the hydrogel ([0106]). Accordingly, it would have been obvious to modify Irvine with Cui to utilize the recited materials as part of the overall hydrogel structure to improve any electrical characteristics of the hydrogel as desired.

As to claim 17, Irvine does not explicitly teach a conductive material, wherein the conductive material optionally comprises a metal nanoparticle, graphene-based material, conductive polymer, or an ionomer, or a combination thereof. Cui teaches a hydrogel to be used in combination with an electrode system ([0099]) in which the hydrogel comprises polymers such as polypyrrole and PEDOT (i.e. poly(3,4-ethylenedioxythiophene)) to improve the electrical characteristics of the hydrogel, as well as incorporating conductive polymer within the hydrogel ([0106]). Accordingly, it would have been obvious to modify Irvine with Cui to utilize

the recited materials as part of the overall hydrogel structure to improve any electrical characteristics of the hydrogel as desired.

Claim(s) 7 is/are rejected under 35 U.S.C. 103 as being unpatentable over Irvine et al. (US 2020/0377929) in view of Woodbury et al. (US 2020/0016567).

As to claim 7, Irvine does not explicitly teach that the linker functional group comprises a phosphoramidite functional group; or an acrydite functional group. However, Woodbury teaches that a peptide can be physically tethered via a linker molecule such as a phosphramidite functional group ([0040]). Accordingly, it would have been obvious to utilize a known material that can perform the function as it would be an obvious substitution that yields similar, and thus expected, results.

Claim(s) 10-11 is/are rejected under 35 U.S.C. 103 as being unpatentable over Irvine et al. (US 2020/0377929) in view of Steelman (US 2020/0181710).

As to claim 10, Irvine does not teach the probe further comprises a quencher, and the probe is optionally reversibly bound to a quencher, or is optionally tethered to the quencher via covalent bonding, intermolecular bonding, physical adsorption, conjugation, or a combination thereof. Steelman teaches a device for detection of biological markers in which a probe comprise a quencher moiety is attached to the probe ([0207]). Accordingly, it would have been obvious to modify Irvine with Steelman to enable quenching of materials when the target has

not been bound, thereby increasing the contrast in signal between a detected and undetected state and increasing the accuracy of the device.

As to claim 11, Steelman teaches the probe comprises a nucleic acid and the quencher comprises a sequence partially or fully complimentary to at least a portion of the nucleic acid sequence ([0207]).

Claim(s) 12 is/are rejected under 35 U.S.C. 103 as being unpatentable over Irvine et al. (US 2020/0377929) in view of Steelman (US 2020/0181710), and further in view of Li (US 2017/0131298).

As to claim 12, while Irvine teaches the probe comprises a nucleic acid ([0017]), the above combination fails to teach the quencher comprises a graphene-based material, wherein the graphene-based material optionally comprises graphene-oxide (GO) nanosheets, graphene-oxide (GO) nanoparticles, graphene-oxide (GO) nanocomposites, or a combination thereof. Li teaches that graphene oxide in various forms can be used as a quencher ([0066]). As such, it would have been obvious to modify the above combination with Li to utilize a known material that can act as a quencher as an obvious substitution yielding similar and thus expected results.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHRISTIAN JANG whose telephone number is (571)270-3820. The examiner can normally be reached Monday-Friday (7-3:30 EST).

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is

encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Chen can be reached at 571-272-3672. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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CHRISTIAN JANG
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9/9/25