

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference OIL4-63774WO	FOR FURTHER ACTION	See item 4 below
International application No. PCT/US2019/022786	International filing date (<i>day/month/year</i>) 18 March 2019 (18.03.2019)	Priority date (<i>day/month/year</i>) 19 March 2018 (19.03.2018)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant BAKER HUGHES HOLDINGS LLC		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 5 sheets, including this cover sheet.																								
In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																									
3.	This report contains indications relating to the following items: <table style="width: 100%;"> <tr> <td style="width: 5%; text-align: center;">☒</td> <td style="width: 25%;">Box No. I</td> <td style="width: 70%;">Basis of the report</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☐	Box No. VIII	Certain observations on the international application
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4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Date of issuance of this report 22 September 2020 (22.09.2020) Authorized officer Athina Nickitas-Etienne e-mail: pct.team4@wipo.int
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PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:
BEEBE, James

Baker Hughes, a GE company, LLC 11211 FM 2920 Tomball,
Texas 77375 USA

Date of mailing
(day/month/year) **24 June 2019 (24.06.2019)**

Applicant's or agent's file reference OIL4-63774WO		FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/US2019/022786	International filing date (day/month/year) 18 March 2019 (18.03.2019)	Priority date(day/month/year) 19 March 2018 (19.03.2018)	
International Patent Classification (IPC) or both national classification and IPC C09K 8/60(2006.01)i, E21B 43/20(2006.01)i, E21B 49/00(2006.01)i, E21B 41/00(2006.01)i			
Applicant BAKER HUGHES, A GE COMPANY, LLC			

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis. I(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR International Application Division Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578	Date of completion of this opinion 24 June 2019 (24.06.2019)	Authorized officer NAM, EUI HO Telephone No. +82-42-481-5580
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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2019/022786

Box No. 1 Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*. I(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

- a. ☐ forming part of the international application as filed:
☐ in the form of an Annex C/ST.25 text file.
☐ on paper or in the form of an image file.
- b. ☐ furnished together with the international application under PCT Rule 13*ter*. I(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
- c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*. I(a)).
☐ on paper or in the form of an image file (Rule 13*ter*. I(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2019/022786

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-15	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-12	YES
	Claims	13-15	NO
Industrial applicability (IA)	Claims	1-15	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: WO 2011-149789 A1 (STEPAN COMPANY) 01 December 2011

D2: US 2017-0322132 A1 (HALLIBURTON ENERGY SERVICES, INC.) 09 November 2017

D3: US 2016-0319663 A1 (HALLIBURTON ENERGY SERVICES, INC.) 03 November 2016

D4: EP 3000862 A1 (SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.)
30 March 2016

D5: NEGIN, CHEGENIZADEH et al., "Most common surfactants employed in chemical enhanced oil recovery", Petroleum, 2017, Vol. 3, No. 2, pages 197-211

I. Novelty and Inventive Step (PCT Article 33(2) and (3))

1. Claims 1-12

The subject matter of claim 1 differs from these prior art documents D1-D5 in that a method comprises: evaluating phase behavior of candidate surfactant blends to select surfactant blends that form a Winsor III system with a crude oil and an injection fluid at a reservoir temperature, wherein each candidate surfactant blend comprises at least a first surfactant which has a higher relative affinity for the crude oil than for the injection fluid and at least a second surfactant which has a higher relative affinity for the injection fluid than for the crude oil; and evaluating the selected surfactant blends in a porous media. And it is not obvious to a person skilled in the art by the documents D1-D5, taken alone or in combination. Therefore, claim 1 is novel and involves an inventive step.

Claims 2-12 are directly or indirectly dependent on claim 1. Therefore, claims 2-12 are novel and involve an inventive step.

Continued on Supplemental Box

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of : Box No. V

2. Claims 13-15

As described in section 1, the method of claims 1-12 is novel and involves an inventive step. However, D1, which is considered to be the closest prior art to the subject matter of claim 13, discloses a process for enhanced oil recovery from an oil-bearing formation comprising introducing into said formation an aqueous composition comprising: water; a sulfonated internal olefin surfactant; and co-surfactants such as ethoxylated hydrocarbons (see paragraphs [0001], [0013], [0014], [0134]).

Comparing the optimal surfactant blend provided by the method of claims 1-12 with a surfactant mixture of the sulfonated internal olefin surfactant and ethoxylated hydrocarbons of D1, there is no difference therebetween in the constituent or property. Although claim 13 differs from D1 in that a method is for enhancing waterflood efficiency in oil recovery, it would be easily conceived by a person skilled in the art from the disclosure of D1 that the process is for enhanced oil recovery by introducing the aqueous composition (see paragraphs [0001], [0013]).

The additional feature of claim 14 is merely a variation of the disclosure of D1 that the composition contains about 15-85 wt.% of water, about 15-85 wt.% of the sulfonated internal olefin surfactant, and about 0-50 wt.% of optional components, and the co-surfactants are used in combination with the sulfonated internal olefin surfactant (see paragraphs [0001], [0134], [0138]).

The additional feature of claim 15 is not disclosed in D1. However, it can be easily optimized by repeated experiments practiced by a person skilled in the art.

Therefore, claims 13-15 lack an inventive step over D1.

II. Industrial Applicability (PCT Article 33(4))

Claims 1-15 meet the requirements of industrial applicability.

[NOTE]

- The phrase "an optimal surfactant blend according to any one of claims 1 to 12" of claim 13 is considered to be a typo for "an optimal surfactant blend by the method according to any one of claims 1 to 12".
- The phrase "the 5reservoir" of claim 15 is considered to be a typo for "the reservoir".