CLAIMS

WHAT IS CLAIMED IS:

1. An optical computing method to predict hydrate formation, the method comprising:

allowing fluid to flow through a first conduit;

separating a sample fluid from the fluid flowing through the first conduit;

allowing the sample fluid to flow through a second conduit;

detecting at least one property of the sample fluid corresponding to hydrate formation using at least one Integrated Computational Element ("ICE") computing device positioned along the second tubular; and

determining whether the detected at least one property is adequate for hydrate formation.

2. A method as defined in claim 1, wherein the at least one property of the sample fluid comprises at least one of a C1 hydrocarbon, C2 hydrocarbon, C3 hydrocarbon, C4 hydrocarbon or water.

3. A method as defined in claim 2, wherein the at least one property of the sample fluid further comprises at least one of a pressure within the first conduit or a temperature of the first conduit.

4. A method as defined in claim 1, further comprising generating an alert signal when it is determined the detected at least one property is adequate for hydrate formation.

5. A method as defined in claim 1, further comprising performing at least one mitigation technique when it is determined the detected at least one property is adequate for hydrate formation.

6. A method as defined in claim 1, wherein the first conduit is part of a pipeline or wellbore tubular.

7. An optical computing device to predict hydrate formation, comprising:

an electromagnetic radiation source that optically interacts with a sample fluid to produce sample-interacted light;

an Integrated Computational Element ("ICE") that optically interacts with the sample-interacted light to generate optically interacted light that corresponds to at least one property of the sample fluid relating to hydrate formation; and

a detector positioned to receive the optically interacted light and thereby generate a signal corresponding to the at least one property relating to hydrate formation, the signal being utilized to determine whether the at least one property is adequate for hydrate formation.

8. An optical computing device as defined in claim 7, further comprising a signal processor communicably coupled to the detector to determine whether the at least one property is adequate for hydrate formation.

9. An optical computing device as defined in claim 7, wherein the at least one property of the sample fluid comprises at least one of a C1 hydrocarbon, C2 hydrocarbon, C3 hydrocarbon, C4 hydrocarbon or water.

10. An optical computing device as defined in claim 9, wherein the at least one property of the sample fluid further comprises at least one of a pressure within the first conduit or a temperature of the first conduit.

11. An optical computing device as defined in claim 8, wherein the signal processor is configured to generate an alert signal when it is determined the at least one property is adequate for hydrate formation.

12. An optical computing device as defined in claim 7, wherein the optical computing device is positioned along a primary conduit, the optical computing device further comprising:

an inflow conduit extending into the primary conduit to separate the fluid sample from a primary fluid stream and communicate the fluid sample to the ICE; and

a return conduit to return the fluid sample back to the primary conduit.

13. An optical computing device as defined in claim 12, wherein the primary conduit is a pipeline or wellbore tubular.

14. An optical computing method to predict hydrate formation, the method comprising:

receiving a sample fluid into an Integrated Computational Element ("ICE") computing device;

detecting at least one property of the sample fluid corresponding to hydrate formation using the ICE computing device; and

determining whether the detected at least one property is adequate for hydrate formation.

15. A method as defined in claim 14, wherein the at least one property of the sample fluid comprises at least one of a C1 hydrocarbon, C2 hydrocarbon, C3 hydrocarbon, C4 hydrocarbon or water.

16. A method as defined in claim 15, wherein the at least one property of the sample fluid further comprises at least one of a pressure or temperature reading.

17. A method as defined in claim 14, further comprising generating an alert signal when it is determined the detected at least one property is adequate for hydrate formation.

18. A method as defined in claim 14, further comprising performing at least one mitigation technique when it is determined the detected at least one property is adequate for hydrate formation.

19. A method as defined in claim 14, wherein the ICE computing device is positioned along a pipeline or wellbore tubular.

20. A method as defined in claim 14, wherein determining whether the detected at least one property is adequate for hydrate formation further comprises:

continuously monitoring the detected at least one property;

determining one or more trends based upon the detected at least one property; and

utilizing the one or more trends to determine whether hydrate formation will occur.

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1. An optical computing method to predict hydrate formation, the method comprising:

allowing fluid to flow through a first conduit;

separating a sample fluid from the fluid flowing through the first conduit;

allowing the sample fluid to flow through a second conduit;

detecting at least one property of the sample fluid corresponding to hydrate formation using at least one Integrated Computational Element ("ICE") computing device positioned along the second tubular; and

determining whether the detected at least one property is adequate for hydrate formation.

2. A method as defined in claim 1, wherein the at least one property of the sample fluid comprises at least one of a C1 hydrocarbon, C2 hydrocarbon, C3 hydrocarbon, C4 hydrocarbon or water.

3. A method as defined in claim 2, wherein the at least one property of the sample fluid further comprises at least one of a pressure within the first conduit or a temperature of the first conduit.

4. A method as defined in claim 1, further comprising generating an alert signal when it is determined the detected at least one property is adequate for hydrate formation.

5. A method as defined in claim 1, further comprising performing at least one mitigation technique when it is determined the detected at least one property is adequate for hydrate formation.

6. A method as defined in claim 1, wherein the first tubular is part of a pipeline or wellbore tubular.

7. An optical computing device to predict hydrate formation, comprising:

an electromagnetic radiation source that optically interacts with a sample fluid to produce sample-interacted light;

an Integrated Computational Element ("ICE") that optically interacts with the sample-interacted light to generate optically interacted light that corresponds to at least one property of the sample fluid relating to hydrate formation; and

a detector positioned to receive the optically interacted light and thereby generate a signal corresponding to the at least one property relating to hydrate formation, the signal being utilized to determine whether the at least one property is adequate for hydrate formation.

8. An optical computing device as defined in claim 7, further comprising a signal processor communicably coupled to the detector to determine whether the at least one property is adequate for hydrate formation.

9. An optical computing device as defined in claim 7, wherein the at least one property of the sample fluid comprises at least one of a C1 hydrocarbon, C2 hydrocarbon, C3 hydrocarbon, C4 hydrocarbon or water.

10. An optical computing device as defined in claim 9, wherein the at least one property of the sample fluid further comprises at least one of a pressure within the first conduit or a temperature of the first conduit.

11. An optical computing device as defined in claim 8, wherein the signal processor is configured to generate an alert signal when it is determined the at least one property is adequate for hydrate formation.

12. An optical computing device as defined in claim 7, wherein the optical computing device is positioned along a primary conduit, the optical computing device further comprising:

an inflow conduit extending into the primary conduit to separate the fluid sample from a primary fluid stream and communicate the fluid sample to the ICE; and

a return conduit to return the fluid sample back to the primary conduit.

13. An optical computing device as defined in claim 12, wherein the primary conduit is a pipeline or wellbore tubular.

14. An optical computing method to predict hydrate formation, the method comprising:

receiving a sample fluid into an Integrated Computational Element ("ICE") computing device;

detecting at least one property of the sample fluid corresponding to hydrate formation using the ICE computing device; and

determining whether the detected at least one property is adequate for hydrate formation.

15. A method as defined in claim 14, wherein the at least one property of the sample fluid comprises at least one of a C1 hydrocarbon, C2 hydrocarbon, C3 hydrocarbon, C4 hydrocarbon or water.

16. A method as defined in claim 15, wherein the at least one property of the sample fluid further comprises at least one of a pressure or temperature reading.

17. A method as defined in claim 14, further comprising generating an alert signal when it is determined the detected at least one property is adequate for hydrate formation.

18. A method as defined in claim 14, further comprising performing at least one mitigation technique when it is determined the detected at least one property is adequate for hydrate formation.

19. A method as defined in claim 14, wherein the ICE computing device is positioned along a pipeline or wellbore tubular.

20. A method as defined in claim 14, wherein determining whether the detected at least one property is adequate for hydrate formation further comprises:

continuously monitoring the detected at least one property;

determining one or more trends based upon the detected at least one property; and

utilizing the one or more trends to determine whether hydrate formation will occur.