[0003] Onshore pipelines may also be inspected for mechanical damage using pigs. However, as onshore pipelines run above ground and more commonly are buried a few feet below the ground, pipe integrity may also be monitored by walking along the path of the pipe or tubular conduit with various sensing equipment, such as acoustic emission tools, to detect any failure.

SUMMARY

[0004] This summary is provided to introduce a selection of concepts that are further described below in the detailed description. This summary is not intended to identify key or essential features of the claimed subject matter, nor is it intended to be used as an aid in limiting the scope of the claimed subject matter.

[0004a] In an aspect, the present disclosure refers to a method comprising: providing a length of pipeline, the pipeline comprising: a housing, wherein the housing includes an inner layer having an inner surface defining a central bore extending the length of the pipe, an outer layer having an outer surface, and one or more intermediate layers disposed between the inner layer and the outer layer, wherein the one or more intermediate layers comprise one or more layers of helically wound strips; and a conduit formed within a section of the one or more intermediate layers and extending the length of the pipe, wherein the conduit comprises spaces formed between the helically wound strips; continuously monitoring at least one condition within the conduit to detect in real time if a change in the housing occurs.

[0004b] In another aspect, the present disclosure refers to a method comprising: providing a length of pipe, the pipe comprising: a housing, the housing comprising: an inner layer having an inner surface defining a central bore extending the length of the pipe; an outer

layer having an outer surface; one or more intermediate layers disposed between the inner layer and the outer layer, wherein the one or more intermediate layers comprise one or more layers of helically wound strips; a conduit formed within a section of the one or more intermediate layers and extending the length of the pipe, wherein the conduit comprises spaces formed between the helically wound strips; and a signal transmitting material disposed within the conduit; and continuously receiving a signal from the signal transmitting material to detect a condition of the housing.

[0004c] In another aspect, the present disclosure refers to a method comprising: continuously monitoring temperature along a length of a pipe, the pipe comprising a housing, the housing comprising: an inner layer having an inner surface defining a central bore extending the length of the pipe; an outer layer having an outer surface; one or more intermediate layers disposed between the inner layer and the outer layer, wherein the one or more intermediate layers comprise one or more layers of helically wound strips; a conduit formed within a section of the one or more intermediate layers and extending the length of the pipe, wherein the conduit comprises spaces formed between the helically wound strips, and an electrically conducting material disposed within the conduit; and applying a current to the electrically conducting material to heat the electrically conducting material when a preselected temperature is detected.

[0005] In an example, there is provided a method that includes providing a length of pipeline, the pipeline having a space formed within the thickness of the pipline housing and extending the length of the pipeline, and continuously monitoring at least one condition within the space to detect in real time if a change in the housing occurs.

[0006] In another example, there is provided a method that includes providing a length of pipeline, the pipeline having a signal transmitting material disposed within the

thickness of the pipeline housing, and continuously receiving a signal from the signal transmitting material to detect a condition of the housing.

[0007] In yet another example, there is provided a method that includes continuously monitoring temperature along a length of a pipeline, the pipeline having an electrically conducting material disposed within the thickness of the pipeline

CLAIMS

What is claimed is:

1. A method, comprising:

providing a length of pipeline, the pipeline comprising:

a housing, wherein the housing includes

an inner layer having an inner surface defining a central bore extending the length of the pipe,

an outer layer having an outer surface, and

one or more intermediate layers disposed between the inner layer and the outer layer, wherein the one or more intermediate layers comprise one or more layers of helically wound strips; and

a conduit formed within a section of the one or more intermediate layers and extending the length of the pipe, wherein the conduit comprises spaces formed between the helically wound strips;

continuously monitoring at least one condition within the conduit to detect in real time if a change in the housing occurs.

2. The method of claim 1, wherein the conduit comprises a predetermined amount of gas, and the at least one condition being continuously monitored comprises pressure.

3. The method of claim 2, wherein at least one pressure transducer continuously monitors the pressure of the conduit.

4. The method of claim 2, further comprising monitoring temperature along the pipe and comparing the pressure to the temperature to determine if a pressure change is from a temperature change.

5. The method of claim 1, wherein a gas composition within the conduit is continuously monitored.

6. The method of claim 5, wherein the gas composition is continuously monitored by continuously flowing a gas through the conduit and testing the gas after the gas exits at least one venting port formed in the housing.

7. The method of claim 5, wherein the gas composition is continuously monitored by extracting a gas from at least one venting port formed in the housing at an interval and testing the gas composition of the gas after extraction.

8. The method of claim 1, wherein the length of pipe comprises a plurality of pipe segments and at least one pipe joint connecting adjacent pipe segments together in an end-to-end configuration, wherein the conduit continuously extends through the pipe segments and the at least one pipe joint.

9. A method, comprising:

providing a length of pipe, the pipe comprising:

a housing, the housing comprising:

an inner layer having an inner surface defining a central bore extending the length of the pipe;

an outer layer having an outer surface;

one or more intermediate layers disposed between the inner layer and the outer layer, wherein the one or more intermediate layers comprise one or more layers of helically wound strips;

a conduit formed within a section of the one or more intermediate layers and extending the length of the pipe, wherein the conduit comprises spaces formed between the helically wound strips; and

a signal transmitting material disposed within the conduit; and

continuously receiving a signal from the signal transmitting material to detect a condition of the housing.

10. The method of claim 9, wherein the signal transmitting material comprises an electrically conducting material.

11. The method of claim 10, wherein the electrically conducting material is electrically insulated within the conduit.

12. The method of claim 10, further comprising applying an electrical current through the signal transmitting material, wherein the condition being detected is a voltage drop across the signal transmitting material.

13. The method of claim 10, wherein the signal transmitting material comprises at least two wires, and further comprising:

applying a voltage to a first wire of the at least two wires; and

measuring voltage along a second wire of the at least two wires, the signal comprising the measured voltage;

wherein the condition detected by the measured voltage is moisture.

14. The method of claim 10, wherein the signal transmitting material forms a Faraday cage around the longitudinal conduit.

15. The method of claim 10, wherein the signal comprises a voltage drop from a change in the condition of the housing, further comprising determining an amount of resistivity through the voltage drop to calculate a location of the change.

16. The method of claim 9, wherein the length of pipe comprises a plurality of pipe segments and at least one pipe joint connecting adjacent pipe segments together in an end-to-end configuration, wherein the signal transmitting material is continuously disposed through the pipe segments and the at least one pipe joint.

17. The method of claim 16, wherein each of the at least one pipe joint comprises:

an annular space formed at each axial end of the pipe joint;

an electrically conducting ring disposed at a base of each annular space; and

an electrically conducting material contacting each electrically conducting ring; and

wherein the signal transmitting material in the pipe segments contact the electrically conducting rings in each pipe joint.

18. The method of claim 16, further comprising disposing an electrically insulating material at least around the at least one pipe joint in the length of pipe, wherein the signal transmitting material is an electrically conducting material, and wherein the at least one pipe joint is formed of the electrically conducting material.

19. A method, comprising:

continuously monitoring temperature along a length of a pipe, the pipe comprising a housing, the housing comprising:

an inner layer having an inner surface defining a central bore extending the length of the pipe;

an outer layer having an outer surface;

one or more intermediate layers disposed between the inner layer and the outer layer, wherein the one or more intermediate layers comprise one or more layers of helically wound strips;

a conduit formed within a section of the one or more intermediate layers and extending the length of the pipe, wherein the conduit comprises spaces formed between the helically wound strips, and an electrically conducting material disposed within the conduit; and

applying a current to the electrically conducting material to heat the electrically conducting material when a preselected temperature is detected.

20. The method of claim 19, wherein temperature is continuously monitored with at least one temperature sensor, and wherein signals from the at least one temperature sensor are transmitted through the electrically conducting material.