

PCT/US2010/022715**What is claimed is:**

1. (Amended) A sensing system comprising:
a sensitive optical fiber (98),
having first (120) and second (118) termini,
having a core (106),
being configured as to be locatedable in an environment which contains substances that chemiluminesce, phosphoresce, fluoresce, scatter or absorb light,
and having at least one exposed core region (92) in direct contact with the environment and acting as a sensitive region of the fiber, in which said sensitive optical fiber is optically affected by the environment;
at least one probing light source (100) producing a probing light which interacts with a measurand medium in the environment of said sensitive region for generating therefrom a modified probing light as substantially aided by said measurand medium interacting with the environment and;
which is substantially coupled into said core as an optical signal (104).
2. (New) The sensing system of claim 1 further comprising
a detector (108) optically coupled with said first terminus (120) of said sensitive optical fiber for reception of the light signal upon exiting said first terminus (120), for measuring an intensity of the light signal over a given range of wavelengths and for correlating the intensity with an electric signal.
3. (New) The sensing system of claim 2 further comprising
a signal processor (110) in data communication with said detector (108);
whereby the electric signal is correlated to a quantity of the measurand being measured.
4. The sensing system of claim 3 further comprising a display in data communication with said signal processor and a power supply (114) configured to provide power to said probing light source, said signal processor, and a display.
5. The sensing system of claim 3 further comprising a display in data communication with said signal processor and a power supply (114) configured to

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provide power to said probing light source, said detector, said signal processor, and a display.

6. The sensing system of claim 1 in which:

said sensitive optical fiber has at least two of its cladding sections removed (92) with at least one exposed core region (92) in direct contact with the environment to provide at least two sensitive regions;

said probing light source illuminates each sensitive region individually, one at a time; and

said probing light optically interacts individually with the environment in each said sensitive region such that a modified probing light is generated therefrom, each such modification having been substantially affected by the measurand medium (93) in the environment.

7. The sensing system of claim 1 in which:

said sensitive optical fiber has at least two of its cladding sections removed (92) with at least one exposed core region (92) in direct contact with the environment to provide at least two sensitive regions;

said probing light sources illuminate two or more sensitive regions simultaneously; and

said probing light optically interacts with the environment in each said sensitive regions such that a modified probing light is generated therefrom, each such modification having been substantially affected by the measurand medium (93) in the environment.

8. The sensing system of claim 1 in which said probing light source illuminates each sensitive region individually, one at a time.

9. The sensing system of claim 1 in which the light source is positionable at any distance from said sensitive region sufficient as to enable said sensitive region to be illuminated.

10. (Amended) The sensing system of claim 1 in which said sensitive region is absent from any chemical indicator.

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11. The sensing system of claim 1 in which said sensing fiber (98) comprises a fiber including its original fiber cladding (116).
12. (Amended) The sensing system of claim 11 in which said sensing fiber (98) includes a sensitive film (99) coated over said original fiber cladding.
13. The sensing system of claim 1 in which the measurand medium comprises one of color, turbidity, analyte and refractive index.
14. The sensing system of claim 1 wherein the environment is located between one of said fiber core and the light source and behind said fiber core.
15. The sensing system of claim 1 wherein said fiber core is surrounded by the environment.
16. (Amended) The sensing system of claim 1 wherein the optical interaction of the probing light with the measurand medium results in one of light absorption, scattering, fluorescence, phosphorescence and chemiluminescence.
17. (Amended) The sensing system of claim 13 wherein said analyte chemically interacts with the environment, thus producing a change in color of the environment.
18. The sensing system of claim 1 wherein said sensitive optical fiber comprises a refractometer to discriminate among environments of different refractive indices.
19. The sensing system of claim 1 wherein said sensitive optical fiber is operable to determine the level of a liquid in contact with the sensor.
20. The sensing system of claim 1 whereas said sensing system is a multi point optical fiber sensor in which each said sensing point is capable of detecting different measurands.

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21. The sensing system of claim 1 whereas said sensing system is a multi point optical fiber sensor in which each said sensing point is illuminated by a plurality of light sources of different wavelengths to detect a plurality of measurands.

22. (Amended) The sensing system of claim 1, wherein said probing light is transmitted by an illumination optical fiber, said illumination fiber having a plurality of dielectric mirrors (180), said illumination fiber being positioned parallel to said sensitive optical fiber, said dielectric mirrors illuminating at an angle said sensitive region of said sensitive optical fiber at discrete positions, wherein a probing light source introduces a probing light into a monochromator, said monochromator filtering the probing light to a specified wavelength, said probing light at a specified wavelength being axially introduced to said illumination optical fiber, said probing light at a specified wavelength propagating to its specified dielectric mirrors having similar wavelength characteristics, and said specified dielectric mirror redirecting the probing light at an angle towards said sensitive region of said sensitive fiber, wherein each of said dielectric is designed to couple light from said bound mode core of said illumination optical fiber into radiation modes at specific wavelengths, and wherein the radiation modes of a specific wavelength illuminate said sensitive region.

23. (Amended) The illumination optical fiber of claim 22 wherein at least one section of said illuminated fiber has its cladding removed, said section with a removed cladding is side illuminated by a plurality of probing light sources that couple their light into the core of the illumination fiber as bound and leaky modes for illuminating said sensitive fiber.

24. (New) The sensing system of claim 1 whereas each said sensitive region is illuminated by a plurality of light sources of different wavelengths to detect a single measurand.

25. (New) An illumination fiber (144) comprising
an optical fiber having first (120) and second (118) termini,
having a core (106) and at least one exposed core region (92),
at least one probing light source (100) producing a probing light,

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said probing light side illuminates said exposed core region, and is substantially coupled into said core as an illumination light (150).

26. (New) The illumination fiber of claim 25 further comprising a tapered core (107), diverging towards one of the directions of propagation of the light, to increase the amount of illumination light that propagates towards that direction.

27. (New) The illumination fiber of claim 25 further comprising a tapered core (107), diverging towards both directions of propagation of the light, to increase the amount of illumination light that propagates in both directions.

28. (New) The illumination fiber of claim 25, having one of at least one dielectric mirror (180) and at least one long period grating along its length, said each dielectric mirror and long period grating capable of redirecting light of said probing light source within an specific wavelength range to the outside of said illumination fiber.

29. (New) The illumination fiber of claim 26 further comprising one of at least one dielectric mirror (180) and at least one long period grating along its length, said each dielectric mirror and long period grating capable of redirecting light of said probing light source within an specific wavelength range to the outside of said illumination fiber.

30. (New) The illumination fiber of claim 27 further comprising one of at least one dielectric mirror (180) and at least one long period grating along each direction of propagation of the light, said each dielectric mirror and long period grating capable of redirecting light of said probing light source within an specific wavelength range to the outside of said illumination fiber.

31. (New) The sensing system of claim 1 further comprising a tapered core (107), diverging towards the direction of propagation of the light, to increase the amount of optical signal that is guided towards the fiber end.

32. (New) The sensing system of claim 2 further comprising a second detector (108) optically coupled with said second terminus (118) of said optical fiber for

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reception of the light signal upon exiting said second terminus (118), for measuring an intensity of the light signal over a given range of wavelengths and for correlating the intensity with an electric signal.

33. (New) The illumination optical fiber of claim 22, in the absence of the monochromator, wherein at least one section of said illuminated fiber has its cladding removed, said section with a removed cladding is side illuminated by a plurality of probing light sources that couple their light into the core of the illumination fiber as bound and leaky modes for illuminating said sensitive fiber.

34. (New) The sensing system of claim 1 whereas said sensing system is a multi point optical fiber sensor in which each said sensing point is illuminated by a plurality of light sources simultaneously of different wavelengths to detect a plurality of measurands.

35. A method of measuring a property of a substance comprising:
providing an apparatus consistent with that of claim 3;
applying at least one substance to be tested to at least one exposed core region;
energizing at least one probing light source to illuminate the at least one exposed core region;
detecting and measuring light being emitted from a terminus of the apparatus;
comparing the light measurement with previously taken measurements with substances of known properties.