CLAIMS

1. An optical fiber for sensing an analyte, the optical fiber comprising:

   a dielectric core wall comprising a dielectric material and defining a hollow space;

   a cladding layer surrounding the dielectric core wall and spaced apart from the dielectric core wall; and

   a plurality of supports extending from the cladding layer to the dielectric core wall;

   wherein a thickness of the dielectric core wall is greater than a thickness of each of the plurality of supports; and

   wherein the dielectric core wall is configured to guide and confine an optical light in the dielectric material via total internal reflection for generating an evanescent field outside the dielectric core wall for sensing the analyte.

2. The optical fiber according to claim 1,

   wherein the dielectric material is a glass material or a polymer material.

3. The optical fiber according to claim 2,

   wherein the glass material is silica, borosilicate glass, tellurite glass, or chalcogenide glass.

4. The optical fiber according to any one of claims 1 to 3,

   wherein the thickness of the dielectric core wall is any one value selected from a range from 0.1 μm to 5 μm.

5. The optical fiber according to any one of claims 1 to 4,

   wherein the thickness of each of the plurality of supports is any one value selected from a range from 0.05 μm to 5 μm.

6. The optical fiber according to any one of claims 1 to 5,

wherein an inner surface of the dielectric core wall is any one value selected from a range from 3 μm^2 to 2×10^5 μm^2.

7. The optical fiber according to any one of claims 1 to 6,
wherein each of the plurality of supports is a strut.

8. The optical fiber according to any one of claims 1 to 7,
wherein the plurality of supports, the dielectric core wall and the cladding layer define multiple holes.

9. The optical fiber according to claim 8,
wherein a sum of inner surfaces of the multiple holes is any one value selected from a range from 5 μm^2 to 8×10^5 μm^2.

10. The optical fiber according to any one of claims 1 to 9,
wherein each of the plurality of supports forms a secondary hollow space with the dielectric core wall.

11. The optical fiber according to any one of claims 1 to 10, further comprising:
a plurality of nanostructures arranged along an inner circumference and an outer circumference of the dielectric core wall.

12. The optical fiber according to any one of claims 1 to 11,
wherein at least one end portion of the optical fiber is tapered.

13. The optical fiber according to claim 12,
wherein a diameter of the dielectric core wall at the at least one tapered end portion of the optical fiber is less than a diameter of the dielectric core wall at a middle portion of the optical fiber.

14. The optical fiber according to claim 12,

wherein the dielectric core wall at the at least one tapered end portion of the optical fiber has a solid core.

15. A method of forming an optical fiber for sensing an analyte, the method comprising:

forming a dielectric core wall comprising a dielectric material and defining a hollow space;

forming a cladding layer surrounding the dielectric core wall and spaced apart from the dielectric core wall;

forming a plurality of supports extending from the cladding layer to the dielectric core wall;

wherein a thickness of the dielectric core wall is greater than a thickness of each of the plurality of supports; and

wherein the dielectric core wall is configured to guide and confine an optical light in the dielectric material via total internal reflection for generating an evanescent field outside the dielectric core wall for sensing the analyte.

16. The method according to claim 15

wherein the dielectric material is a glass material or a polymer material.

17. The method according to claim 16,

wherein the glass material is silica, borosilicate glass, tellurite glass, or chalcogenide glass.

18. The method according to any one of claims 15 to 17,

wherein the thickness of the dielectric core wall is any one value selected from a range from 0.1 μm to 5 μm.

19. The method according to any one of claims 15 to 18,

wherein the thickness of each of the plurality of supports is any one value selected from a range from 0.05 μm to 5 μm.

20. The method according to any one of claims 15 to 19,

wherein an inner surface of the dielectric core wall is any one value selected from a range from 3 μm^2 to 2×10^5 μm^2.

21. The method according to any one of claims 15 to 20,

wherein each of the plurality of supports is a strut.

22. The method according to any one of claims 15 to 19,

wherein the plurality of supports, the dielectric core wall and the cladding layer define multiple holes.

23. The method according to claim 22,

wherein a sum of inner surfaces of the multiple holes is any one value selected from a range from 5 μm^2 to 8×10^5 μm^2.

24. The method according to any one of claims 15 to 23,

wherein each of the plurality of supports forms a secondary hollow space with the dielectric core wall.

25. The method according to any one of claims 15 to 24, further comprising:

a plurality of nanostructures arranged along an inner circumference and an outer circumference of the dielectric core wall.

26. The optical fiber according to any one of claims 15 to 25,

wherein at least one end portion of the optical fiber is tapered.

27. The optical fiber according to claim 26,

wherein a diameter of the dielectric core wall at the at least one tapered end portion of the optical fiber is less than a diameter of the dielectric core wall at a middle portion of the optical fiber.

28. The optical fiber according to claim 26,

wherein the dielectric core wall at the at least one tapered end portion of the optical fiber has a solid core.

29. A method of using an optical fiber for sensing an analyte, the method comprising:

providing the analyte to the optical fiber, wherein the optical fiber comprises a dielectric core wall comprising a dielectric material and defining a hollow space, a cladding layer surrounding the dielectric core wall and spaced apart from the dielectric core wall, and a plurality of supports extending from the cladding layer to the dielectric core wall;

providing an optical light to the dielectric core wall configured to guide and confine the optical light in the dielectric material via total internal reflection for generating an evanescent field outside the dielectric core wall for sensing the analyte; and

determining the optical light at an output of the optical fiber;

wherein a thickness of the dielectric core wall is greater than a thickness of each of the plurality of supports.

30. The method according to claim 29, further comprising:

arranging a plurality of nanostructures along an inner circumference and an outer circumference of the dielectric core wall.

31. The method according to claim 29 or claim 30,

wherein the analyte is sensed via absorption spectroscopy, fluorescence-based detection, Surface Plasmon resonance method or Raman spectroscopy.