A further object is to provide a supercontinuum light source comprising a PCF with a high resistance against degradation as well as preferred applications of such supercontinuum light source.

These and other objects have been solved by the invention or embodiments thereof as defined in the claims and as described herein below.

In accordance with a first aspect of an embodiment, there is provided a supercontinuum light source comprising a Photonic Crystal Fiber (PCF) and a pump source arranged to feed pump pulses to a launching end of said PCF, said PCF has a longitudinal axis and comprising a solid core extending along the length of said longitudinal axis and a cladding region surrounding the core, wherein at least the cladding region comprises a plurality of microstructures in the form of inclusions extending along the longitudinal axis of the PCF in at least a microstructured length section, wherein the PCF in at least a degradation resistant length section of said microstructured length section comprises hydrogen and/or deuterium and comprises a main coating surrounding the cladding region, wherein the main coating is hermetic for said hydrogen and/or deuterium at a temperature below T_h, and wherein T_h is at least 50 ^oC.

In accordance with a second aspect of an embodiment, there is provided a Photonic Crystal Fiber (PCF) for a supercontinuum light source, where the PCF having a longitudinal axis and comprising a solid core extending along the length of said longitudinal axis and a cladding region surrounding the core, wherein at least the cladding region comprises a plurality of microstructures in the form of inclusions extending along the longitudinal axis of the PCF in at least a microstructured length section, wherein the PCF in at least a degradation resistant length section of said microstructured length section comprises hydrogen and/or deuterium, said PCF in at least said degradation resistant length section further comprises a main coating surrounding the cladding region, which main coating is hermetic for said hydrogen and/or deuterium at a temperature below T_h , wherein T_h is at least 50 ^oC.

It has been found that the invention or embodiments thereof have a number of additional advantages which will be clear to the skilled person from the following description.

Photonic Crystal Fiber (PCF) of the invention has a longitudinal axis and comprises a core extending along the length of the longitudinal axis and a cladding region surrounding the core. At least the cladding region comprises a plurality of microstructures in the form of inclusions extending along the longitudinal axis of the PCF in at least a microstructured length section. The PCF has a degradation resistant length section which may be the entire length of the PCF or merely a length section thereof.

The phrase "degradation resistant length section" is used to indicate that the fiber length section has a very high degradation resistance over time relative to other prior art fiber length sections.

The PCF in at least the degradation resistant length section of said microstructured length section comprises hydrogen and/or deuterium and the PCF in at least the degradation resistant length section further comprises a main coating surrounding the cladding region, which main coating is hermetic for said hydrogen and/or deuterium at a temperature below T_h, wherein T_h is at least about 50 ^oC. Advantageously T_h is at least about the maximal expected temperature of the PCF when in use. Thereby a minimum of the hydrogen and/or deuterium is diffused out of the fiber over time and/or during use. Preferably T_h is as follows: 50 $^oC < Th < 250\ ^oC$. In an embodiment T_h is up to about 150 ^oC.

PATENT CLAIMS

1. A supercontinuum light source comprising a Photonic Crystal Fiber (PCF) and a pump source arranged to feed pump pulses to a launching end of said PCF, said PCF has a longitudinal axis and comprising a solid core extending along the length of said longitudinal axis and a cladding region surrounding the core, wherein at least the cladding region comprises a plurality of microstructures in the form of inclusions extending along the longitudinal axis of the PCF in at least a microstructured length section, wherein the PCF in at least a degradation resistant length section of said microstructured length section comprises hydrogen and/or deuterium and comprises a main coating surrounding the cladding region, wherein the main coating is hermetic for said hydrogen and/or deuterium at a temperature below T_h, and wherein T_h is at least 50 ^oC.

2. The supercontinuum light source of claim 1, wherein 50 $^oC < T_h < 250$ ^oC.

3. The supercontinuum light source of claim 1, wherein the plurality of inclusions in the cladding region is arranged in a pattern comprising at least two rings of inclusions surrounding the core.

4. The supercontinuum light source of claim 1, wherein the inclusions comprise gas inclusions, the gas inclusions are closed on both sides of said degradation resistant length section.

5. The supercontinuum light source of claim 1, wherein the plurality of inclusions in the cladding region of at least said degradation resistant length section comprises an inner cladding region comprising at least one inner inclusion and an outer cladding region comprising at least one outer inclusion wherein the inner inclusion is larger than said outer inclusion.

6. The supercontinuum light source of claim 5, wherein the inner inclusions comprise at least one ring of inclusions and the outer inclusions comprise at least one ring of outer inclusions.

7. The supercontinuum light source of claim 5, wherein the inner inclusions have a diameter d_{inner} which is at least 15 % larger than a diameter d_{outer} of the outer inclusions.

8. The supercontinuum light source of claim 1, wherein the cladding region in at least said degradation resistant length section comprises an inner cladding region comprising the inclusions and an outer cladding region surrounding the inner cladding region, wherein the radial distance between an outermost inclusion of the inner cladding region and the main coating is at least 10 µm.

9. The supercontinuum light source of claim 1, wherein an innermost inclusion in at least said degradation resistant length section has a center-to-center distance to the core of less than 50 µm.

10. The supercontinuum light source of claim 1, wherein at least the core of the PCF is essentially free of Germanium and/or is essentially undoped silica or fluorine doped silica.

11. The supercontinuum light source of claim 1, wherein at least the core of the PCF is essentially free of active material.

12. The supercontinuum light source of claim 1, wherein the main coating comprises nitride, carbon, aluminum, gold, cobber, nickel, metallic glass or a combination or an alloy comprising one or more of the before mentioned.

13. The supercontinuum light source of claim 1, wherein the PCF comprises at least one tapered length section wherein said core in a first end of the tapered length section has a core diameter D1 and said core in a second end of the tapered length section has a core diameter D2, wherein D1 is larger than D2.

14. The supercontinuum light source of claim 1, wherein the PCF comprises two or more spliced fiber length sections, wherein at least one spliced fiber length section is or comprises said degradation resistant length section.

15. The supercontinuum light source of claim 1, wherein the PCF comprises a mode-adaptor extending along the length of the PCF in at least a mode-field adapting length section extending from the launching end of the PCF or up to 5 cm from the launching end of the PCF, wherein said mode-field adapting length section has a length of at least 5 cm.

16. The supercontinuum light source of claim 1 wherein said PCF is arranged to generate a supercontinuum light with a broadened band width relative to the bandwidth of said pump pulses.

17. The supercontinuum light source of claim 1, wherein the pump pulses generated by said pulse source are high peak power pulses having a peak power at the launching end of said PCF of at least 5 kW.

18. The supercontinuum light source of claim 1, wherein the pump pulses generated by said pulse source have a pulse duration of up to 200 ps.

19. The supercontinuum light source of claim 1, wherein the supercontinuum light source has an average output power of at least 1W.

20. The supercontinuum light source of claim 1, wherein the supercontinuum light source has an output comprising wavelengths less than 600 nm.

21. The supercontinuum light source of claim 1, wherein the supercontinuum light source further comprises a spectral filtering unit, arranged to filter the output of said supercontinuum source to a filtered supercontinuum output having a central wavelength of $\lambda 1$ and an output bandwidth BW1, wherein at least one

of the central wavelength of λ1 and the output bandwidth BW1 is tunable, said output bandwidth BW1 is advantageously less than 5 nm.

22. A Photonic Crystal Fiber (PCF) for a supercontinuum light source, where the PCF having a longitudinal axis and comprising a solid core extending along the length of said longitudinal axis and a cladding region surrounding the core, wherein at least the cladding region comprises a plurality of microstructures in the form of inclusions extending along the longitudinal axis of the PCF in at least a microstructured length section, wherein the PCF in at least a degradation resistant length section of said microstructured length section comprises hydrogen and/or deuterium, said PCF in at least said degradation resistant length section further comprises a main coating surrounding the cladding region, which main coating is hermetic for said hydrogen and/or deuterium at a temperature below T_h , wherein T_h is at least 50 ^oC.

23. The Photonic Crystal Fiber of claim 22, wherein 50 $^oC < T_h < 250\ ^oC$.