TECHNOLOGY OFFER

Optical fiber with a shaped photosensitivity profile for producing structures with photoinduced modulation of refractive index, in particular Bragg gratings

Łukasiewicz Institute of Microelectronics and Photonics

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Patent information

Technology readiness level: 2-3

Title: Optical fiber with a shaped photosensitivity profile for producing structures with photoinduced modulation of refractive index, in particular Bragg gratings

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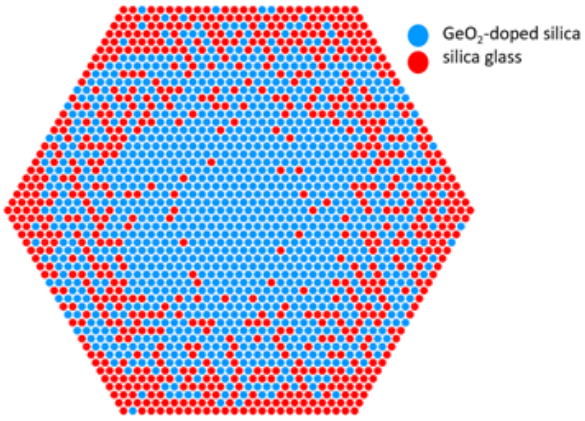
Inventors: Ryszard Buczyński, Tomasz Osuch, Alicja Anuszkiewicz, Konrad Markowski, Marcin Franczyk, Rafał Kasztelanic, Dariusz Pysz

Jurisdictions: Poland

The invention relates to an optical fibrer with a shaped photosensitivity profile by core nanostructuring. Photosensitivity shaping is obtained by arbitrary distribution of photosensitive (germanium doped silica) and silica glass rods of subwavelength diameter of at least λ/3 [1,2,3,4]. Addition of third type of glass rods, i.e. fluorine doped silica also allows to obtain a fiber with independently shaped photosensitivity and refractive index profiles of the fiber.



[1] DOI: 10.1038/s41598-018-30284-1 A. Anuszkiewicz, et. al., "Fused silica optical fibers with graded index nanostructured core ", Sci. Rep. 8, art. 12329, pp. 1-13 (2018);
[2] DOI: 10.1364/OME.9.004370 A. Anuszkiewicz, et. al., "Experimental analysis of axial stress distribution in nanostructured core fused silica fibers," Opt. Mater. Express 9, 4370-4378 (2019);
[3] DOI: 10.1364/OE.390521 T. Osuch, A. Anuszkiewicz, et. al., "Enhancement of spectral response of Bragg gratings written in nanostructured and multi-stepped optical fibers with radially shaped GeO2 concentration", Opt. Express 28, pp. 14774-14787 (2020);
[4] DOI: 10.1364/OE.413433 M. Franczyk, et. al.,"Nanostructured active and photosensitive silica glass for fibre lasers with built-in Bragg gratings," Opt. Express, vol. 29, no 7, pp. 10659-10675 (2021).

Technology Summary

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The potential behind the technology

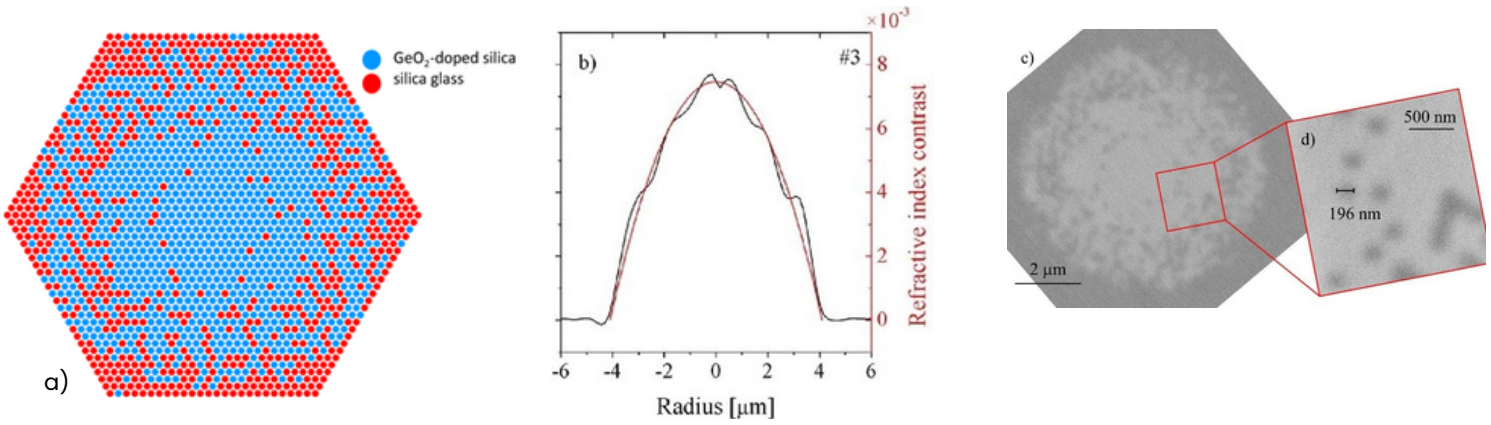
Photosensitivty of the fiber allows for inscription of fiber Bragg gratings (FBGs), acting as an narrowband optical filters for application in optical fiber lasers and sensors. Photosensitivity shaping was never considered before, however it has a potential for strengthen the selected mode overlap with the FBG area or to create photosensitivity profile of active fibers, independent on its refractive index and gain profile.

Technology Advantages

The main advantage of the invention is shaping the photosensitivity profile with use of only two glass materials, i.e. fused silica and germanium doped silica with no symmetry limits. Another advantage is independent photosensitivity shaping and refractive index shaping by adding third glass material, e.g. fluorine doped silica. Summarizing, only three types of glass materials are enough to independently shape refractive index and photosensitivity, thus have full control over propagation performance of the fiber and FBG overlap with the selected modes.

Application

Such a fiber is used in lasers technology, telecommunications, and in sensing as well.



a) The design of optical fiber core structure according to the invention [1] with b) intentionally shaped parabolic effective refractive index profile in the core [2] and c) image of developed fiber with d) zoomed core area with indication of nanorods diameter [3].

Collaboration type

License agreement or sale agreement

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