Bioresorbable microstructured phosphate glass optical fiber for theranostic applications

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In recent decades, optical fibers have raised increasing interest in the field of theranostics due to their easy integration in catheters and other medical instrumentation and to their ability to transmit light and act as drug delivery systems in capillary form. Optical fibers are also desirable since they can be drawn into kilometers starting from a single preform, thus allowing their production scalability.

In this scenario, phosphate glass optical fibers can be regarded as great candidates thanks to their mechanical reliability both in dry and humid environments, radiation durability and biocompatibility. Furthermore, phosphate-based glasses can become biocompatible and resorbable materials, upon properly tailoring their compositions.

We report on the design and fabrication of a multifunctional bioresorbable microstructured phosphate glass optical fiber. Different glass compositions were tested and their reabsorption time in a simulated body fluid was found to be tailored by finely dosing MgO and CaO. These features make such fiber suitable for implantation-e.g. after a surgery-for localized treatment. In addition, we show the application of the multifunctional fiber to deliver a photosensitive drug and its activation by light carried with the same fiber. We also report on in-vivo tests of the bioresorbable fiber on male laboratory rats, showing no clinical signs of adverse effects.

Keywords:

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Theranostics
Drug delivery