Towards a novel bi-functional bioresorbable micro-structured optical fiber for theranostic applications

Jawad T. Pandayil[a,b], Seyed H. Mussavi Rizi[b], Sharon Russo[b], Nadia Giovanna Boetti[a], Diego Pugliese[b,c], and Davide Janner[b]

[a]*Fondazione LINKS-Leading Innovation and Knowledge for Society, via P. C. Boggio 61, 10138 Torino, Italy*

[b]*Dipartimento di Scienza Applicata e Tecnologia (DISAT) and RU INSTM, Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129 Torino, Italy*

[c]*Dipartimento di Elettronica e Telecomunicazioni (DET), Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129 Torino, Italy*

Abstract

Calcium phosphate glasses offer an exclusive combination of optical, bioresorbable, and enhanced thermo-mechanical properties, making them an attractive material for fabricating resorbable biomedical devices. In the present study, we report the *in vitro* dissolution test of a multimode (MM) phosphate fiber and a hollow fiber in phosphate buffered saline (PBS) solution. The power transmission change with the MM fiber's invitro dissolution is also presented. Then, using the same respective glass compositions of the MM fiber and hollow fiber, we report the realization of a novel bi-functional micro-structured optical fiber with a MM core for light delivery and a microfluidic channel for drug delivery. The multistage fabrication process involves the techniques of extrusion, rod-in-tube, and stack-and-draw. The core was tested for light guidance and the channel for liquid delivery. The proposed approach illustrates the vast potentiality of phosphate glass-based micro-structured fibers that could be used as a theranostic device to be implanted at specific areas inside the body without needing an explant procedure.

Acknowledgement: This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 860185