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UNIVERSITÀ DEGLI STUDI FIRENZE Da un secolo, oltre.

Long-period Fiber Gratings Coupled with Imprinted Biopolymers and Hydrogels for Advanced Biosensing Applications

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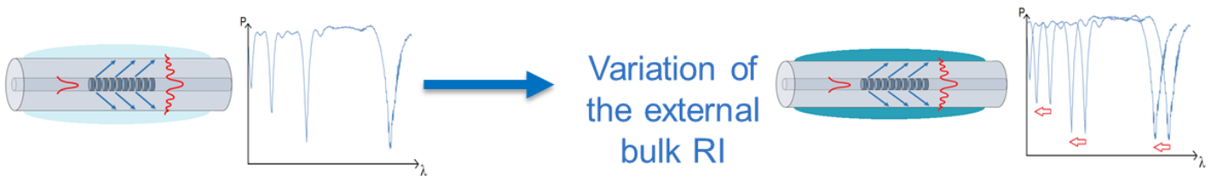
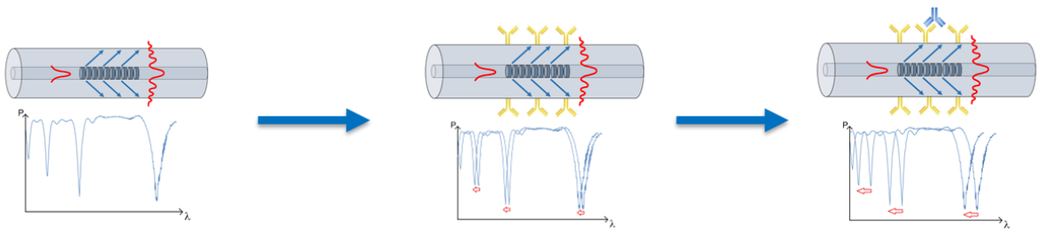
Long period gratings (LPGs) for biosensing

The transmission properties of the light in LPGs are modulated by **changes in the refractive index (RI)** in the region surrounding the fiber, due to the presence of an **evanescent wave** outside the fiber, **penetrating** within the external medium for distances of the order of **hundreds of nanometres**

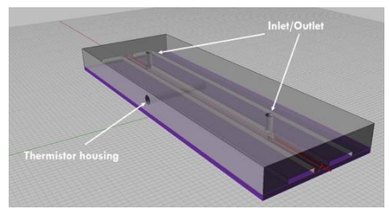


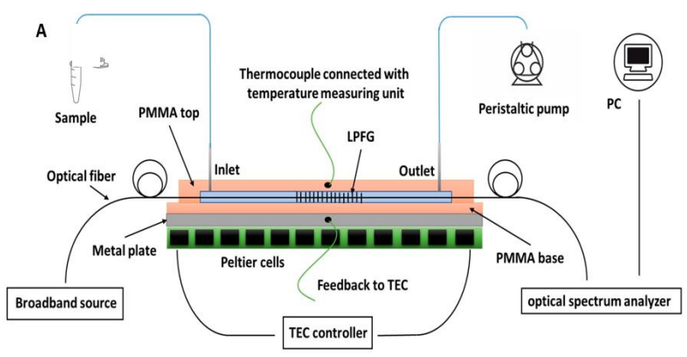
The implementation of a **sensing biolayer** onto the fiber surface containing a biological recognition element (BRE), selective to a well-defined target, gives the opportunity to detect **surface RI changes** associated to the specific biochemical interaction between the target and the biolayer



The exploitation of this optical fiber sensor, together with its integration in a **thermally stabilized closed-flow cell**, allows the coupling of the advantages of the investigated polymers and hydrogels, with the **intrinsic characteristics** of this kind of sensor:

- versatility
- low cost
- portability
- remote sensing capabilities

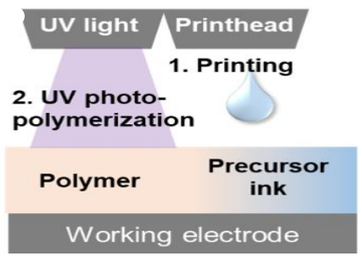


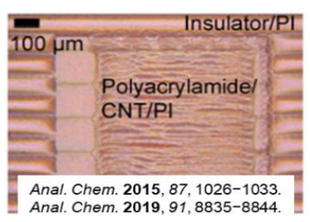


Optical fibers for photopolymerisation of hydrogels and sensing

202259W5FY_PE4_PRIN2022 Point-Of-Care electroanalytical platform for the detection of bacteria and antibiotic resistance

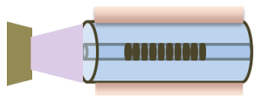
LPGs will be used to study the deposition or growth onto the fiber of polyacrylamide hydrogels.
Porous hydrogels will be coated with **bacteria** specific receptors (aptamers and antibodies) and used to capture bacteria. The metabolism of bacteria will be studied in order to understand their antibiotic resistance.





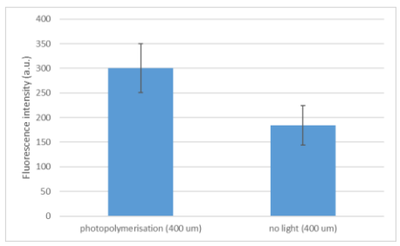
At UNIBO: simultaneous inkjet printing and UV photo-polymerization of acrylamide derivatives

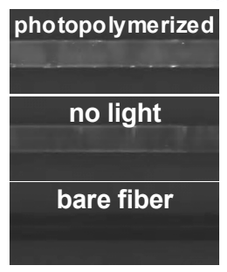
The formation of the polymer is **induced by the evanescent wave** that extends in the external environment only up to a distance comparable to the wavelength of the polymerising light (approximately hundreds of nanometers).



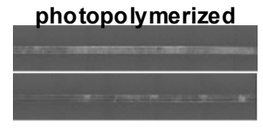
UV light

Upon the formation of the thin layer and the eventual immobilisation on the hydrogel of a BRE, the interaction with the specific target will happen very near to the surface where the fiber sensor has the **maximum sensitivity to surface refractive index changes**.





400 µm core fiber

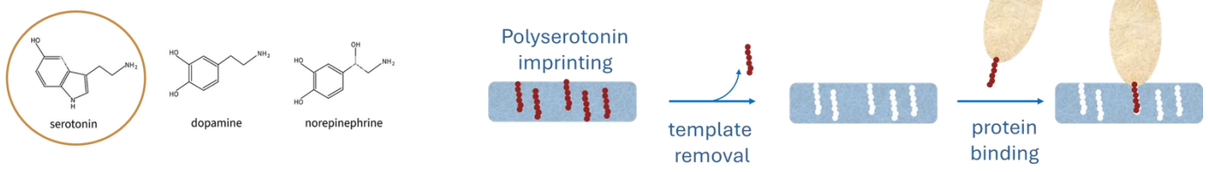


200 µm core fiber

LPGs coupled to polyserotonin as soft MIP

P20227PWE5.PE4 PRIN2022PNRR Discovering the SEcret woRld of pOlyseroTONin for green molecular ImprINting and its application in bioanalytics

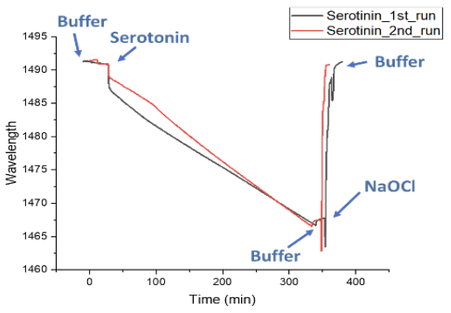
Imprinted Bio-Polymers (IBPs), synthesized through the **spontaneous polymerization of endogenous neurotransmitters** in the presence of a molecular template, represent a promising alternative to conventional Molecularly Imprinted Polymers (MIPs).



Neurotranmitters-based soft MIPs can be prepared in one simple step, by dissolving the monomer and the **template (synthetic peptide for protein epitope imprinting)** together, in mild basic aqueous solutions at room temperature

LPGs were employed to monitor in time the polymerization of serotonin before its imprinting.

Different runs of polymerisation were possible thanks to a **regeneration procedure** based on a fast treatment with sodium hypochlorite



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Projects 202259W5FY_PE4_PRIN2022 Point-Of-Care electroanalytical platform for the detection of bacteria and antibiotic resistance – CUP B53D23013430006; 2022JRKETK_PE7_PRIN2022 Versatile hybrid in-fiBer Optical-electrocHemical systEMs for wIdely Applicable biosensing – CUP B53D23002670006; P20227PWE5.PE4 PRIN2022PNRR Discovering the SEcret woRld of pOlyseroTONin for green molecular ImprINting and its application in bioanalytics – CUP B53D23025260001.