

PHOTONIC MATERIALS & DEVICES

LABORATORY

Objectives/Overview

The **Photonic Materials and Devices-Laboratory (PMDL)** is an Applied Physics research group of FORTH-IESL. Since year 2004, PMDL focuses on the research of materials, light propagation effects, designs and fabrication methods for the development of Photonic Devices, with significant effort currently being invested in Photonic Crystal Fibre (PCF) based devices. The strategic vision of the group refers to the development of hybrid photonic devices and related processes by engaging existing and emerging technologies in a 'disruptive' approach, covering scientific and technology readiness levels from the basic research and the proof-of-principle study, up to the laboratory prototyping.

Since its establishment, PMDL investigated new sensing configurations utilising standard and microstructured optical fibres, while targeting the high socio-economical impact fields of Health and Biology, Energy, Environment, Structural Monitoring and Specialised Instrumentation. Moreover, PMDL has contributed several new demonstrations in the fields of photosensitivity and grating inscription methods, optofluidics and light localisation and device development in PCFs. The scientists of PMDL have participated in numerous European and National Research Projects, delivering highest quality scientific and technological results, covering several parts of the value chain of Photonics.

In addition to its equipment infrastructure, PMDL exploits the world-class laser facilities of [Ultraviolet Laser Facility](#) operating within IESL, being capable of providing insight into multi-disciplinary optical physics and engineering problems. Since November 2013, PMDL constitutes a partner of the FP7 IP Project [ACTPHAST](#)- Access Center for Photonics Innovation Solutions and Technology Support, providing tailored know-how services to European SMEs and large scale companies, producing or using Photonic Technologies.

Current Research Priorities

- ✦ Research on the development of PCF sensing and actuating devices towards the elaboration of the Lab-in-a-Fibre approach
 - ✦ *Biosensing lab-*
 - ✦ *Materials growth lab mainly including Glasses and Crystals grown-in-a-Fibre*
 - ✦ *Photonic Crystal Fibre Optofluidics, Magnetofluidics*
 - ✦ *Plasmons, Phonons, WGM resonators and advanced grating structures*
 - ✦ *Optomechanics on Fibre Tapers/Endfaces for self-switching and sensing applications*
 - ✦ *Light-localisation exploiting random and periodic media, cavities and guiding and biological structures*
 - ✦ *Developing and scaling down photonic sensors for mobile devices*

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Selected Demonstrations and Highlights

- ✦ First inscription of relief gratings in both solid and hollow PCFs. *OPN-OSA, Optics in 2012*
- ✦ First demonstration of “in-fibre” magnetofluidic sensing and switching devices. *Highlighted by OPN-OSA, Optics in 2011, SPIE in 2011, MRS in 2011 and Frost & Sullivan in 2011*
- ✦ First demonstration of microsphere resonators inside Microstructured Optical Fibres. *OPN-OSA, Optics in 2013*
- ✦ Plasmonic Crystal Fibres utilising soft glass infiltration
- ✦ ZnO hybrid optical fibre sensors for detecting organic vapors
- ✦ Fibre endface Fabry-Perot resonators fabricated using non-linear photopolymerisation
- ✦ Smart pressure and shear sensing pads using optical fibre sensors for advanced rehabilitation applications. *Highlighted by SPIE 2012, shortlisted for Kainotomeis.gr competition 2013.*

Selected Publications

- ✦ M. Konstantaki, P.Childs, M.Sozzi, S.Pissadakis, Relief Bragg reflectors inscribed in solid core photonic crystal fibres, *Laser & Photonic Reviews* 7, 439 (2013)
- ✦ K.Kosma, G.Zito, K.Schuster, S.Pissadakis, Whispering gallery mode microsphere resonator integrated inside a microstructured optical fiber, *Opt. Lett.* 38, 1301-1303 (2013)
- ✦ A.Candiani, M.Sozzi, A.Cucinotta, S.Selleri, R.Veneziano, R.Corradini, R.Marchelli, P.Childs, and S.Pissadakis, Optical fiber ring cavity sensor for label-free DNA detection, *IEEE Journal of Selected Topics in Quantum Electronics* 18, 1176 (2012)
- ✦ M.Konstantaki, A.Klini, D.Anglos, S.Pissadakis, An ethanol vapour detection probe based on a ZnO nanorod overlaid optical fibre long-period grating, *Optics Express* 20, 8472 (2012)
- ✦ I.Konidakis, G.Zito, S.Pissadakis, Photosensitive, all-glass AgPO₃/silica photonic bandgap fiber, *Opt. Lett.* 37, 2499 (2012)
- ✦ A.Candiani, W.Margulis, C. Sterner, M.Konstantaki, and S.Pissadakis, Phase defected Bragg gratings realized in microstructured optical fibres utilizing infiltrated ferrofluids, *Opt. Lett.* 36, 2548 (2011)

Contact

Whether you are an Academic Colleague or an Industrial Collaborator PMDL is a valuable and reliable partner, for establishing a strong scientific collaboration, contributing into a new project consortium, or for providing niche solution into a difficult R&D problem.

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