NANOPHOTONICS TECHNOLOGY CENTER

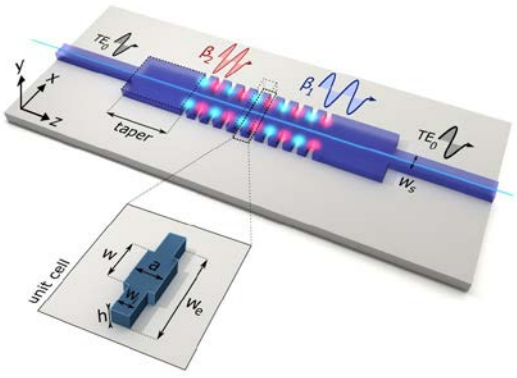
Description of the group

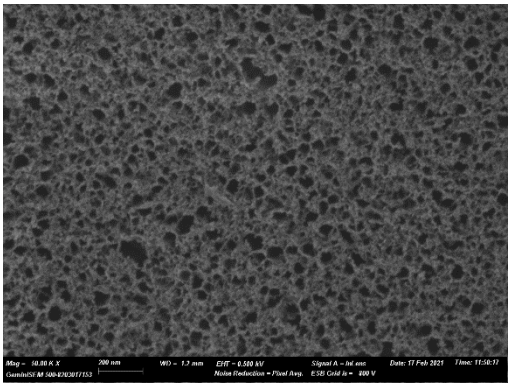
The Biophotonics group is one of the seven research groups within the Nanophotonics Technology Center of the Universitat Politècnica de València. This group is led by Dr. Jaime García Rupérez and it is focused on the development of novel configurations of photonic biosensing devices based on integrated photonics and on porous materials, having application in a wide range of sectors including biomedical, food safety and detection of CBRN threats, among others.

Photonic technology is recognized as one of the main candidates for the development of next generation high performance biosensing devices due to the several advantages that it presents when compared to other technologies, such as high sensitivity, compactness and high integration level, shorter time to result, label-free detection, use of very low sample and reagents volumes, and their immunity to electromagnetic interferences. Additionally, the possibility of using CMOS-compatible materials and mass manufacturing processes to reach very high production volumes and very low costs is another key point for the reached interest.

Our current research interest is focused in obtaining higher sensitivity photonic sensing structures following 2 main paths. On one hand, we work on the development of novel photonic sensing configurations based on periodic structures where we exploit properties like the slow-wave effect, bimodal interferometry or dispersion engineering to obtain a sensitivity enhancement [1-5]. On the other hand, we work on exploring novel approaches for the creation of optical sensing structures based on porous materials, where that pursued sensitivity increase can be obtained by allowing the target analytes to penetrate the sensing structure itself [6-10].

Most of our work in done in the context of R&D projects at European (e.g., H2020-ULISES, H2020-PHOCNOSIS, H2020-SAPHELY, FP7-BELERA, FP7-INTOPSENS) and National level (e.g., PID2019-PHOLOW, TEC2015-OPTONANOSENS, TEC2013-BIOGATE), where we have collaborated with other national and international leading research groups.





Selected recent publications

1. L. Torrijos-Morán, A. Griol, J. García-Rupérez, "Slow light bimodal interferometry in one-dimensional photonic crystal waveguides", Light: Science & Applications, Vol. 10, pp. 16 (2021).
2. L. Torrijos-Morán, A. Brimont, A. Griol, P. Sanchis, J. García-Rupérez, "Ultra-compact optical switches using slow light bimodal silicon waveguides", Journal of Lightwave Technology, Vol. 39, pp. 3495-3501 (2021).
3. P. Martínez-Pérez, M. Gómez-Gómez, T. Angelova, A. Griol, J. Hurtado, L. Bellieres, J. García-Rupérez, "Continuous Detection of Increasing Concentrations of Thrombin Employing a Label-Free Photonic Crystal Aptasensor", Micromachines, Vol. 11, pp. 464 (2020).
4. L. Torrijos-Morán, A. Griol, J. García-Rupérez, "Experimental study of subwavelength grating bimodal waveguides as ultrasensitive interferometric sensors", Optics Letters, Vol. 44, pp. 4702-4705 (2019).
5. Á. Ruiz-Tórtola, F. Prats-Quílez, D. González-Lucas, M-J. Bañuls, Á. Maquieira, G. Wheeler, T. Dalmay, A. Griol, J. Hurtado, J. García-Rupérez, "High sensitivity and label-free oligonucleotides detection using photonic bandgap sensing structures biofunctionalized with molecular beacon probes", Biomedical Optics Express, Vol. 9, pp. 1717-1727 (2018).
6. P. Martínez-Pérez, S. Ponce-Alcántara, N. Murillo, A. Pérez-Márquez, J. Maudes, I. Peraile, L. González-López, M. Gil-García, P. Lorenzo-Lozano, J. García-Rupérez, "Label-free Optical Biosensing Using Low-Cost Electrospun Polymeric Nanofibers", Chemosensors, Vol. 8, pp. 119 (2020).
7. S. Ponce-Alcántara, D. Martín-Sánchez, M. Kovylina, A. Pérez-Márquez, J. Maudes, N. Murillo, J. García-Rupérez, "Dual refractive index and viscosity sensing using polymeric nanofibers optical structures", IEEE Sensors Journal, Vol. 19, pp. 11850-11857 (2019).
8. D. Martín-Sánchez, S. Ponce-Alcántara, J. García-Rupérez, "Sensitivity comparison of a self-standing porous silicon membrane under flow-through and flow-over conditions", IEEE Sensors Journal, Vol. 19, pp. 3276-3281 (2019).
9. P. Martínez-Pérez, J. García-Rupérez, "Commercial polycarbonate track-etched membranes as substrates for low-cost optical sensors", Beilstein Journal of Nanotechnology, Vol. 10, pp. 677-683 (2019).
10. R. Caroselli, S. Ponce-Alcántara, F. Prats Quilez, D. Martín-Sánchez, L. Torrijos Morán, A. Griol Barres, L. Bellieres, H. Bandarenka, K. Girel, V. Bondarenko, J. García-Rupérez, "Experimental study of the sensitivity of a porous silicon ring resonator sensor using continuous in-flow measurements", Optics Express, Vol. 25, pp. 31651-31659 (2017).

Contact

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