Funded by the European Union

FunctiGlass

Project title DC4: Photonic platforms for the detection of pathogens in food production

Recruiting institution: Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Wrocław, Poland

Background

Over the past four decades, **glass, glass-ceramics and composites** have contributed to the most advanced socio-economic breakthroughs as high-tech materials. To compete with emerging economies such as China and India, the European glass sector must strive for product leadership by investing more in research and innovation to develop new materials and train specialists for a competitive but promising market.

Contributing to this challenge is the main objective of the 'Structured functional glasses for lasing, sensing and health applications' (FunctiGlass) project, dedicated to **advanced high-tech materials for three sectors: light sources, sensors and biological applications**.

FunctiGlass, coordinated by CNRS, is a unique interdisciplinary research and training programme with a **double degree** as part of Horizon Europe's Doctoral Networks (Marie-Skłodowska Curie Actions, project 101169415). It will train 11 doctoral candidates who will take part in a joint research training programme based on **very close cooperation between academia and industry**. It will ensure that the trainees are exposed to 11 academic environments (universities and research institutes) and 9 non-academic environments (industry and SMEs) representing 9 different countries. **Each PhD candidate will be supervised by two**

academic tutors from different countries (spending her/his time between both units) and one mentor (industrial partner) to ensure cross-sector knowledge sharing and the acquisition of transferable skills with a focus on entrepreneurship and innovation. Through the multi-dimensional training of the FunctiGlass programme, the 11 PhD candidates will excel in the future economy by acquiring a multi-dimensional perspective and mindset to become **future leaders in glass science and in particular glass-based nano/micro-structured materials.** Through this programme, they will find their own path of innovation in academia or industry.

The project will create the conditions necessary for the establishment of long-term relationships between the academic and private sectors for the transfer of technologies and skills.

5 institutions will award the double degrees: Université Côte d'Azur (Nice, France), Tampere Universities (Finland), Gottfried Wilhelm Leibniz University Hannover (Germany), University Milano-Bicocca (Italy) and the Institute of Low Temperature and Structure Research, Polish Academy of Sciences (Wroclaw, Poland).

Industrial partners: AOI Tech (France), Corning (France), Fastlite (France), Klearia (France), Else Nuclear (Italy), Nobula3D (Sweden), Nyfors Teknologi (Sweden), Rosendahl Nextrom (Finland), Scout Scientific Outsourcing (Poland).

Other universities involved in the project as partners (not awarding doctoral degrees): University of Cergy-Pontoise (France), University of Gent (Belgium), University of Pardubice (Czech Republic), University of Nazarbayev (Kazakhstan), Umeå University (Sweden).

Description of the PhD project

The detection of food pathogens is a critical aspect of food safety, as it ensures the quality of the food supply and helps prevent food-related illnesses. Traditional methods of detecting food pathogens, such as culturing and PCR tests, can be time-consuming, labor-intensive, and may not provide real-time results. This is where newly-proposed photonic structures can be helpful. Photonic structures, such as optical fibers and other waveguides, optically active nanoparticles, or metamaterials, have the potential to revolutionize (bio)sensing by enabling rapid, sensitive, and selective optical detection. These structures can be specifically designed (functionalized) to interact with light in ways that enhance the detection of specific biomarkers or signals associated with bacteria, fungi, or other species. For example, functionalized waveguides can be used in sensing by registering changes in refractive index, Raman scattering, or fluorescence associated with the presence of analytes [1-5]. Development of such optical structures could contribute to overall food safety and consumers' health.

The goal of the research will be design, fabrication, and testing glass-based structures able to give an optical response to selected food pathogens. The experimental work will be preceded by literature research in current development of the proposed optical sensing in the food industry, particularly for bacteria detection. Structures proposed for detection of selected pathogens will be fabricated by a chemical synthesis using sol-gel technology. Different glass-based compositions, metal nanoparticles, system configurations, biomolecules, and surface functionalization for selective pathogen

identification will be tested. Studies will include morphological, structural, mechanical, and optical characterization of the developed photonic systems. Particular attention will be devoted to investigating the interaction of light with the glass and nanoparticles as well as the changes caused by the presence of microorganisms. Eventually, response of the optical platform as a function of pathogen concentration will be described. The expected result is the development of sensitive and selective platform for optical detection of chosen food pathogens.

1. Song et al., Recent progress in nanomaterial-based fluorescence assays for the detection of food-borne pathogens, Sensors 2024, 24(23), 7715; https://doi.org/10.3390/s24237715
2. Abuhelwa et al., Fiber optics-based surface enhanced Raman Spectroscopy sensors for rapid multiplex detection of foodborne pathogens in raw poultry, Microsyst Nanoeng 2024, 10, 199, https://doi.org/10.1038/s41378-024-00834-x
3. Kourti et al., Optical immunosensors for bacteria detection in food matrices, Chemosensors 2023, 11(8), 430; https://doi.org/10.3390/chemosensors11080430
4. Servarayan et al., Optical immunosensor for the detection of listeria monocytogenes in food matrixes, ACS Omega 2023, 8, 15979, https://doi.org/10.1021/acsomega.2c07848
5. Zhao et al., Detection of foodborne pathogens by surface enhanced raman spectroscopy, Front. Microbiol. 2018, 9, 1236, https://doi.org/10.3389/fmicb.2018.01236

Practical information

- Contract will start in October 2025, for 4 years.
- Recruiting institution: Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Wroclaw, Poland
- Doctoral school: Wrocław Doctoral School of Institutes of Polish Academy of Sciences (ILTSR PAS)
- Host laboratory: Division of Optical Spectroscopy, ILTSR PAS
- Supervisor: Ass. Prof. Paweł Głuchowski
- Co-host laboratory: University of Milano Bicocca, Milan, Italy
- Co-supervisor: Prof. Roberto Scotti
- Industrial mentor: Scout Scientific Outsourcing Company (Poland)
- Secondments: Institut de Physique de Nice (France)
- The gross monthly salary based on the MSCA rules varies between 1920€ and 4063€, depending on the country of recruitment.
- The student will also receive a mobility allowance and a family allowance (depending on family situation) of up to 600 € and 495€ per month, respectively.

Recruitment criteria

- MSCA Mobility Rule: researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting beneficiary (Poland) for more than 12 months in the 36 months immediately before their date of recruitment
- All researchers recruited in a DN must be doctoral candidates (i.e. not already in possession of a doctoral degree at the date of the recruitment)
- Possession of a Master’s degree before the start date of the contract
- Scientific interests to fit the PhD project
- Fluent (oral and written) English skills as the project operates in English
- Knowledge of the language of the host countries may be considered a merit
- Team-mindedness

Criteria specific for PhD4

- Knowledge in materials science
- Knowledge in inorganic materials processing and characterization
- Knowledge in microbiology and work experience in microbiological laboratory will be considered a merit
- Work experience in chemical laboratory
- Scientific interests to fit the PhD project (in optics, spectroscopy, and/or biosensing).
- Master degree in Chemistry, Materials Science or related disciplines

Application
Documentation to be sent in by the applicants

- Application form completed
- CV + Letter of motivation
- Contact of two reference persons to be contacted by the selection committee (name, relation to the candidate, e-mail address and phone number)
- Complete list of publications and academic works
- Proof of language proficiencies
- Proof of master diploma or 2024 registration to master degree

How to apply?

- Download application form and fill it indicating all the offers you wish to apply for
- Send your application by email to **recruit@functiglass.eu**. The title of your email MUST be:
  FunctiGlass PhD x, x, x application (x, x, x being the number(s) of the PhD position(s)you want to apply for)
- Be careful to join all documentation required (see list above)

Deadline for application
15th April 2025

Contact
contact@functiglass.eu