Funded by
the European Union

FunctiGlass

Project title DC8: Scintillating Glasses for Real Time Dosimetry

Recruiting institution: University of Milano-Bicocca (Italy)

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

FLASH radiotherapy is an emerging approach in radiation therapy. It involves the delivery of ultra-high dose rate radiation to destroy cancer cells[1,2]. Recent results report of a reduced radiation-induced toxicity to healthy tissues from FLASH irradiation when compared with conventional dose delivery in multiple sessions at lower dose rates. Both the development of this technique and of the irradiation sources require precise real time dosimeters working on extreme conditions. Ultra-high dose rates, in fact require materials with a good radiation hardness, capable of withstand high doses delivered by charged radiation (electron beams). Moreover, a good time response (hundreds of ns or less) of the detector is desirable to allow monitoring the time profile of the pulsed irradiation. Finally, it is important to reduce as much as possible the so called “stem effect” by either using high efficiency scintillating materials or by relying on scintillators emitting in the red/IR range (allowing an optical filtering of the non-dosimetric UV/Blue emission responsible for the stem effect). In this project, various materials will be synthesized, fully characterized and tested to fulfill all the requirements of the FLASH therapy. In particular, phosphate and silicate glasses activated with rare-earths or other luminescent ions will be produced by exploiting a sol-gel procedure. Suitable thermal treatments will be investigated to promote homogeneous and durable materials. Moreover, the possibility of using plastic or nanocomposite scintillators will also be considered.
The research activity will involve detailed spectroscopic characterization of the synthesized materials using different techniques including wavelength-resolved thermoluminescence (in the 10 K- 700 K temperature range), photoluminescence (10 K - 500 K), optical absorption (10 K - 320 K), time-resolved photo-luminescence (from few ns to hundreds of ms), pulsed X-ray luminescence, micro-Raman spectroscopy, micro-IR transmission, radio-luminescence (10 K - 320 K), X-ray fluorescence.

[1] Favaudon V, Caplier L, Monceau V, Pouzoulet F, Sayarath M, Fouillade C, et al. Ultrahigh dose-rate FLASH irradiation increases the differential response between normal and tumor tissue in mice. Sci Transl Med 2014;6(245):245ra93.
[2] Wilson JD, Hammond EM, Higgins GS, Petersson K. Ultra-high dose rate (FLASH) radiotherapy: silver bullet or fool's gold? Front Oncol 2020;9:1563.

Practical information

- Contract will start in October 2025, for 3 years.
- Recruiting institution: University of Milano-Bicocca (Italy)
- Doctoral school: Milano-Bicocca Doctoral School (Italy)
- Industrial mentor: ELSE Nuclear
- Host laboratory: Department of Material's Science – University of Milano-Bicocca (Italy)
- Supervisor: Prof. Mauro Fasoli
- Co-host laboratory: Institut de Physique de Nice (France)
- Co-supervisor: Prof. Franck Mady
- Secondments: The research activity of will include a mandatory secondment, at ELSE Nuclear, lasting 1 month.
- 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 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 excellence to fit the PhD project
- Fluent (oral and written) English skills as the project operates in English language
- Knowledge of the language of the host country may be considered a merit
- Team-mindedness

Criteria specific for PhD8

- Good knowledge in spectroscopy, ionizing radiation interaction.
- Basic knowledge in solid-state physics.
- Master degree in either Physics or Materials Science (or equivalent).

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