

Two-photon absorption chromophores with emission properties sensible to vapors of nitroaromatic explosives.

Project

The **TNT-Sensor-AI** project aims to combine recent technological advances made in multiphoton stereolithography with artificial intelligence to develop a new generation of multiplexed micro matrix sensors integrating a meta spatially programmable porosity material. The deep learning sensor specialization will be done with the objective of specifically recognizing traces of TNT (2,4,6-trinitrotoluene) in complex gas mixtures. The originality of our project is that it proposes a back-and-forth algorithmic strategy to re-program the sensor at each learning cycle. This advantage is derived from the very high technical flexibility that stereolithography offers for re-programming the porosity properties of the photomaterial on demand.

The task of the post-doctoral researcher will be to develop new a library of biphotonic photoinitiators with really high two-photon cross section. These chromophores will be mainly oligomers $(D-\pi-A-\pi)_n$ integrating in their structure diazine (A) and triphenylamine (D) fragments connected by conjugated electronic relays (phenyl, styryl, ethynyl etc...). Synthesized oligomers will have a dual function: a) Promote two-photon induced photopolymerization at the local scale. b) Make the final material fluorescent with sensibility to nitroaromatic vapors by encapsulation or even covalent grafting of the oligomer in elaborated micro-structures.

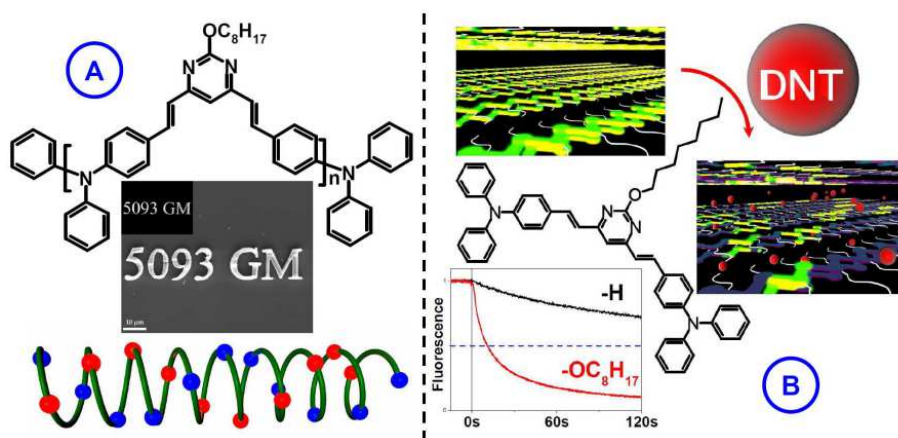


Fig 1: oligomer based fluorophores presenting two-photon absorption and sensibility to the presence of nitroaromatic vapors A. example of stereolithography [1] B. example of detection of vapors of 2,4-dinitrotoluene [2].

Scientific environment

This collaborative research program associates researchers from **Rennes Institute of Chemical Science (ISCR)** (OMC team, <https://iscr.univ-rennes.fr/organometallics-materials-catalysis-omc>) at **University of Rennes** in the framework of a project funded by the **ANR**. **The post-doctoral researcher will work at IUT Lannion (180 km from Rennes)**. Sylvain Achelle, Pascal le Poul and Françoise Robin-le Guen have important expertise in synthesis and study of photophysical properties of diazine-based chromophores [1,2,3]. This project will be in collaboration with Prof. Jean-Pierre Malval (IS2M laboratory, Université Haute-Alsace, Mulhouse France) for the stereolithography, and Dr. Benoît Vozel (IETR laboratory, University of Rennes, Lannion, France) for artificial intelligence aspect and unsupervised learning for image processing.

Description of the position

We are looking for a chemist who has an important experience with synthetic molecular chemistry. We specifically encourage the application of candidates who are motivated to work on challenging and multi-disciplinary projects. The principal work will be the synthesis, the characterization and the study of optical properties of new series of chromophores. According to first results on two-photon polymerisation, modifications of the structure of these biphotonic photoinitiators may be considered. Expertise in the fields of heterocycles and photophysical properties is valuable but not mandatory. The post-doctoral fellow will be offered **18-months fulltime position starting from January 2024**.

Application

For additional information you can contact Sylvain Achelle (sylvain.achelle@univ-rennes1.fr). To apply to this position, please e-mail a complete CV, reference letters or names of references, and a letter of application to sylvain.achelle@univ-rennes1.fr.

References

- [1] J.-P. Malval, S. Achelle, L. Bodiou, A. Spangenberg, L. C. Gomez, O. Soppera, F. Robin-le Guen, *J. Mater. Chem. C* **2014**, *2*, 7869.
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