

FLUORESCENT DENDRITIC MOLECULAR PROBES: FROM SYNTHESIS TO APPLICATIONS

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Host Laboratory: Laboratoire de Chimie de Coordination, LCC, CNRS UPR-8241, 205 route de Narbonne, 31077 Toulouse cedex 4 _ (website: <u>https://www.lcc-toulouse.fr/</u>)

Host Team: Dendrimers and Heterochemistry (website: <u>https://www.lcc-toulouse.fr/en/dendrimers-</u> and-heterochemistry-team-m/)

Conditions: MESR funding granted by the SDM Doctoral School for a period of 3 years starting October 1, 2024.

How to apply: The candidate is invited to send a complete CV, a cover letter, Master's transcripts and the contact details of one or two people referring to Anne-Marie Caminade (<u>anne-marie.caminade@lcc-toulouse.fr</u>) and Aurélien HAMEAU (<u>aurelien.hameau@lcc-toulouse.fr</u>) **before JUNE 25, 2024.**

Context and summary of the thesis project:

The objectives are to develop new fluorescent molecular probes based on the association of the photophysical properties of different types of fluorophores and the chemical and physical properties of PolyPhosphorHydrazone (PPH) dendrimers. Such macromolecules could find applications in the fields of bioimaging, chemical/biological sensors or even organic photovoltaic.¹

Structurally, phosphorus dendrimers have a pseudo-globular shape composed of three parts: the core, the periphery and the internal structure. These dendrimers having phosphorus atoms as points of divergence are particularly suitable for including different organic entities at a well-defined generation within the same nth generation dendrimer. These dendrimers integrating phosphorhydrazone units are made up of phosphorhydrazide and arylaldehyde molecular entities. Their quantitative and reproducible synthesis is based on an iterative process involving a succession of substitution and condensation reactions.²

Classical synthesis of PPH dendrimers



Several types of chromophores that can be incorporated at different levels of the dendrimer (core, branch or surface) are developed in the team. These compounds are of push-pull type involving various donor and acceptor moieties linked together by a pi-conjugated system thienylbenzothiadiazole or fluorenyl, and exhibit emission properties in solution. Other fluorophores derived from tetraphenylethylenes exhibit solid-state and aggregation-induced emission properties.

¹ A.-M. Caminade, and coll, *Dendrimers: towards catalytic, material and biomedical uses*, Wiley: Chichester, UK, **2011**, 1-538. A.-M. Caminade and coll. *Chemistry A European Journal*, **2009**, 15(37), 9270-9285; *ChemPlusChem*, **2019**, 84(8), 1070–1080; *Beilstein J. Org. Chem.*, **2019**, 15, 2287–2303; *Chem. Eur. J.* **2019**, 25, 3637-3649; *Helvetica Chimica Acta*, **2023**, 106(7), e202300048. K. Moineau-Chane Ching and coll, *New J. Chem.*, **2016**, 40, 7326-7337.

² A.-M. Caminade, and coll, Angew. Chem. Int. Ed. Engl. **1994**, 33, 1589-1592; Dalton Trans., **2016**, 45, 1810-1822; Pure and Applied Chemistry, **2016**, 88(10-11), 919.

Profile and skills sought:

The candidate should have good theoretical knowledge in organic and organometallic chemistry, and a strong taste for synthesis. He/she should have experimental skills in synthesis (working under inert atmosphere with vacuum-line), in purification methods (distillation, column chromatography, crystallization, extraction, etc.), in analysis and characterization of organic and organophosphorus molecules. (NMR, IR, MS, etc.). Basic knowledge of phosphorus chemistry, UV-visible and fluorescence spectroscopy will be appreciated. An ability to design and conduct experiments independently, work creatively and rigorously, and analyze and interpret data critically are fundamental. Motivation for research, team spirit and scientific curiosity are highly recommended assets.