

# Pinene-pyridine derivatives: synthesis, self-assembly and sensing applications

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Chiral ligands with a pinene-(poly)pyridine backbone have received considerable attention in the field of coordination chemistry due to their ability to efficiently induce chirality at metal ion centers upon coordination, forming homochiral species.

The present PhD thesis deals primarily with the development of the chemistry of pinene-(bi)pyridine ligands. New chiral, enantiopure pinene-pyridine compounds were obtained and their behavior was investigated in solution and in solid state. Further, their complexation towards lanthanide ions was studied, in order to determine a trend and understand their binding behavior with the final goal of obtaining enantiopure, supramolecular architectures. Moreover, a novel reaction starting from ring-annealed pyridines was discovered and its reaction scope was investigated. A reaction mechanism was proposed, showing how the isoindolone product was more favored than the symmetric anhydride. The same compound has proven to be a very efficient phosgene sensor, so an in-depth analytical study was performed, showing how this compound can be efficient in detecting phosgene at even non-toxic concentrations, making it suitable for real-life applications.

The final part of the thesis involves a project that was developed during a nine-month stay in the group of Prof. Luisa De Cola in the field of photophysics. Novel donor-acceptor compounds based on Zn(II) complexes with salen-type ligands, as well as a purely organic amphiphile were synthesized and their photophysical properties were investigated. An interplay between thermally-activated delayed fluorescence (TADF) and room-temperature phosphorescence (RTP) was discovered and the influence of donor-acceptor position, number and orientation was determined.

## Jury:

Prof. Dr. Fabio Zobi, University of Fribourg, Switzerland (president of the jury)  
Prof. Dr. Katharina M. Fromm, University of Fribourg, Switzerland (thesis supervisor)  
Prof. Dr. Olimpia Mamula, HEIA-FR, Switzerland (thesis co-supervisor)  
Prof. Dr. Christophe Allemann, HEIA-FR, Switzerland (thesis co-supervisor)  
Prof. Dr. Christian Bochet, University of Fribourg, Switzerland (internal co-examiner)  
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