ITI HiFunMat Master Internship Proposal

☐ M 1 ☒ M 2

Toward the development and study of new Thermally Activated Delayed Fluorescent dyes for use in Organic Light Emitting Diodes

Internship supervisor

Name, first name	D'ALEO Anthony
E-mail, Telephone	anthony.daleo@ipcms.unistra.fr
Laboratory	Institut de physique et chimie des Matériaux de Strasbourg (IPCMS UMR 7504)
Collaboration with a HiFunMat member (*please indicate their name*)	☒ No ☐ Yes :

Student profile looked for

Master program (*more than one box can be ticked)*	☒ Material science and engineering ☒ Chemistry ☐ Physics
Other indications if necessary	

Internship description

Since the first demonstration of the organic solid state laser diode (OSLD)[1], continuous effort has been devoted to designing more efficient devices. The structure of the OSLD is very similar to those used for Organic Light-Emitting Diodes (OLEDs), a technology already on the market.

However, in the example developed by Adachi *et al.*,[1] the organic dye emits in the blue part of the spectrum, which prevents the devices from having a long lifetime, since blue OLEDs are not yet very stable. In this context, there is a huge need for new dyes that emit at a wavelength longer than blue to incorporate in organic electronic devices. In this context, dyes giving green, orange and near-infrared emissions that show a lasing effect have recently been published[2-4]. In those examples, the dyes harvest their triplet excited state which improves tremendously the performance of the device.

Therefore, this project aims to synthesize and characterize new molecules for OSLD/OLEDs that harvest triplet excited state such as Thermally Activated Delayed Fluorescence dyes. The student will synthesize and purify the molecules. In addition, further characterization of photophysical properties (characterization by absorption, emission in solution and in the film form) will be carried out.

[1]: Sandanayaka, A. S. D.; Matsushima, T.; Bencheikh, F.; Terakawa, S.; Potscavage, W. J.; Qin, C.; Fujihara, T.; Goushi, K.; Ribierre, J.-C.; Adachi, C.: Indication of current-injection lasing from an organic semiconductor. Applied Physics Express 2019, 12, 061010

[2]: Kim, D.-H.; D'Aléo, A.; Chen, X.-K.; Sandanayaka, A. D. S.; Yao, D.; Zhao, L.; Komino, T.; Zaborova, E.; Canard, G.; Tsuchiya, Y.; Choi, E.; Wu, J. W.; Fages, F.; Brédas, J.-L.; Ribierre, J.-C.; Adachi, C.: High-efficiency electroluminescence and amplified spontaneous emission from a thermally activated delayed fluorescent near-infrared emitter. Nature Photonics 2018, 12, 98-104.

[3]: Ye, H.; Kim, D. H.; Chen, X.; Sandanayaka, A. S. D.; Kim, J. U.; Zaborova, E.; Canard, G.; Tsuchiya, Y.; Choi, E. Y.; Wu, J. W.; Fages, F.; Bredas, J.-L.; D'Aléo, A.; Ribierre, J.-C.; Adachi, C.: Near-Infrared Electroluminescence and Low Threshold Amplified Spontaneous Emission above 800 nm from a Thermally Activated Delayed Fluorescent Emitter. Chemistry of Materials 2018, 30, 6702-6710.

[4]: Tang, X.; Lee, Y.-T.; Feng, Z.; Ko, S. Y.; Wu, J. W.; Placide, V.; Ribierre, J.-C.; D'Aléo, A.; Adachi, C.: Color-Tunable Low-Threshold Amplified Spontaneous Emission from Yellow to Near-Infrared (NIR) Based on Donor–Spacer–Acceptor–Spacer–Donor Linear Dyes. ACS Materials Letters 2020, 2, 1567-1574.