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| <b>Title of post</b>                     | <b>PhD position on synthetic chemistry</b>   |
| <b>General information</b>               | Place: Institut des Sciences Chimiques de Rennes (UMR6226) - France<br>Publication date of offer 01/09/19<br>Type of contract: CDD Doctorant CNRS (European ITN Funding Européen ITN).<br>Duration: 36 months<br><b>Expected start date of thesis:</b> 01/01/20 or within the next 9 months<br>Proportion of work: full time (100%) Remuneration: around 2 100 € per month plus travel and family allowances.  |
| <b>Description of the subject thesis</b> | <p><b>Objective and subject of the thesis, scientific field and scientific themes</b></p> <p>The goal of this PhD is to develop chiral Organic Light-Emitting Diodes (OLEDs) and Organic Light-Emissive Transistors (OLETs) based on new small helical molecules or helical <math>\pi</math>-conjugated oligomers. It will take advantage of two novel concepts: <i>i</i>) The Chiral Induced Spin Selectivity (CISS) effect.<sup>1</sup> It has been found that the transmission of electrons through chiral molecules depends on their spin. According to this novel CISS concept, the electrons injected into and from the light-emitting species have their spin predetermined and this significantly enhances the efficiency of the LEDs, a critical issue in view of the desire to reduce the energy consumption of electronic devices. <i>ii</i>) The emission of circularly polarized light (CPL).<sup>2</sup> The use of CPL emitting OLED material would increase the efficiency of the device by allowing more light to pass through polarized filters currently used for eliminating parasitic reflections. Furthermore, CPL is central to a large range of current and future technologies and so CP light emitting devices would allow for additional functionalities (stereoscopic [3D] displays, enhanced bandwidth optical communication, <i>in vivo</i> imaging). These goals require to make progress in: 1) the development of strongly emissive chiral molecular materials suitable for integration into device technologies, 2) the study of their properties, and 3) the production of proof-of-concept devices.</p> <p>The main part of the project will be devoted to the synthesis of chiral organic and organometallic molecules<sup>3</sup> with different electronic properties and the study of their photophysical and chiroptical properties (UV-vis absorption, circular dichroism, circularly polarized luminescence) in solution and immobilized on surfaces. Applications in optoelectronic devices and chiral electrochemical sensing will then be conducted depending on the obtained chiroptical properties.</p> <p><b>Bibliographical references</b></p> <p>[1] a) B. Goehler <i>et al.</i>, <i>Science</i> <b>331</b>, 894 (2011). b) P. C. Mondal, C. Fontanesi, D. H. Waldeck, R. Naaman, <i>Acc. Chem. Res.</i> <b>49</b>, 2560 (2016); c) C. Fontanesi, <i>Current Opinion in Electrochemistry</i> <b>7</b>, 36 (2018). [2] a) Y. Yang <i>et al.</i>, <i>Adv. Mater.</i> <b>25</b>, 2624 (2013); b) F. Zinna <i>et al.</i>, <i>Adv. Mater.</i> <b>27</b>, 1791 (2015); c) E. Peeters <i>et al.</i>, <i>J. Am. Chem. Soc.</i> <b>119</b>, 9909 (1997); d) S. M. Jeong <i>et al.</i>, <i>App. Phys. Lett.</i> <b>90</b>, 211106 (2007); e) J. R. Brandt <i>et al.</i> <i>J. Am. Chem. Soc.</i> <b>138</b>, 9743 (2016); f) F. Zinna <i>et al.</i>, <i>Adv. Funct. Mater.</i> <b>27</b>, 1603719 (2017). [3] a) N. Saleh, C. Shen and J. Crassous, <i>Chem. Sci.</i> <b>5</b>, 3680 (2014); b) C. Shen <i>et al.</i>, <i>Angew. Chem. Int. Ed. Engl.</i> <b>55</b>, 8062 (2016); c) N. Hellou <i>et al.</i>, <i>Angew. Chem. Int. Ed.</i> <b>56</b>, 8236 (2017); d) P. Josse <i>et al.</i> <i>Chem. Eur. J.</i> <b>23</b>, 6277 (2017).</p> <p><b>Detailed presentation of the research project (cooperative aspect)</b></p> <p>This PhD position is within the framework of a European ITN</p> |

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|   | <p>project named HEL4CHIROLEDs: Helical systems for chiral organic light emitting diodes. Under the supervision of Jeanne Crassous, (Director of Research CNRS,OMC team), the doctorant will study and perform synthetic chemistry (of chiral <math>\pi</math>-conjugated materials and organometallics), perform photophysical measurements, study applications in optoelectronic devices (OLEDs and OPVs), and be in relation with topics in chirality and in physics (spin selectivity). He/She will be also involved in scientific/soft-skills meetings and in research activities conducted in other laboratories/companies from Europe and associated countries.</p> <p><b>Material and financial scientific conditions of the research project</b><br/>Financial support will be provided for family and for travel allowance</p> <p><b>Objective of promoting the research work of the doctoral student</b><br/>Many soft skills activities (writing CVs, performing interviews, visiting private sector, organizing meetings, social media, gender aspects) will be set-up for improving employability.</p>  |
| <p><b>Work context</b></p>              | <p>The "Institut des Sciences Chimiques de Rennes" (ISCR – UMR 6226) is a Mixed Laboratory associating CNRS (INC et INSIS), and the University of Rennes 1, the "Ecole Nationale Supérieure de Chimie de Rennes" (ENSCR) and the "Institut National des Sciences Appliquées de Rennes" (INSA,Rennes). This Institute, created in January 2006, results from the gathering of the different strong thematics in chemistry in Rennes. It includes around 290 permanent employees, among which 143 Professors and Assistant-professors, 64 CNRS Researchers and 82 Engineers and Technicians, in different sites in Rennes and Lannion, with a total of 500 members. Its organization in eight teams of different sizes efficiently combines a good administrative gestion with high-level scientific activities, covering a large panel of disciplines in chemistry. The chemistry in Rennes has a strong expertise in the conception and synthesis of molecules, of crystals, of tailor-made materials, with dedicated properties, thanks to well-adapted engineering tools. It specifically addresses: molecular chemistry (organic, organometallic and coordination), materials from solid state chemistry and metallurgy, catalysis, electrochemistry, comutational chemistry, and engineering of chemical processes.</p> |
| <p><b>Constraints and risks</b></p>     | <p>Several travels within Europe and in other foreign countries should be expected (participation to workshops and meetings, scientific symposia, one or two secondments of one or two months duration in academic and private sectors), organized within the frame of the European ITN project HEL4CHIROLED.</p>   |
| <p><b>Supplementary information</b></p> | <p>The candidate must have a Master Degree in chemistry. The position requires knowledge in chirality, sound skills in synthetic chemistry (organic and organometallic), purification methods, characterization techniques, spectroscopic tools, data processing softwares, a high level of communication skills, both oral and written (French and English required) to be able to present at conferences and write articles in scientific publications, flexibility adaptability, and creativity. We are looking for a PhD fellow who will be able to become fully involved within the project, with a thirst for knowledge, a certain independence of thought and strong motivation to develop scientific skills in chiral materials science together with soft skills. In addition, the candidate must be able to work in a team on multi-disciplinary projects.</p> <p>The Applicant must have not resided in France for more than 12 months in the 3 years immediately before the recruitment date (and not have carried out their main activity (work, studies, etc.) in that country – unless as part of a procedure for obtaining refugee status under the Geneva Convention.</p>  |

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|  | <p><b>Applications must be sent to Jeanne Crassous (jeanne.crassous@univ-rennes1.fr).</b></p> <p>Applications must include a detailed CV; at least two references (people who may be contacted); a cover letter of one page; a one-page résumé of the dissertation for the Masters; grades for the Masters 1 or 2 or the engineering degree).</p> <p>Our Institute is submitted to security conditions (Restricted Research Zone, ZRR).</p> |
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