Realization of printed-sustainable large area indoor-photovoltaic mini-modules

Place of employment and planned mobility: Centre National de la Recherche Scientifique (CNRS) - Centre Interdisciplinaire de Nanoscience de Marseille (CINaM) - Aix Marseille Université at Campus of Luminy - 13288 Marseille Cedex 09, France.

Doctoral Candidate will benefit from the project's consortium for secondments to partner companies. Two secondments are planned over the 36-month period with 3 months in ECO RECYCLING SOCIETA at ROMA in Italy and with 4 months in EPISHINE AB established at LINKOPING in Sweden.

Supervisor: Dr. Christine Videlot-Ackermann

Context: The work of CINaM-CNRS doctoral student is an integral part of the MENTOR project, the first international network to bring together 8 universities, 7 industrial partners and 5 research centers. The MENTOR project involves 17 individual doctoral student projects and received funding from the European Union's Horizon Europe (HORIZON) Marie Skłodowska-Curie Actions Doctoral Networks (MSCA-DN) (see https://projects.tuni.fi/mentor/). The aim of the MENTOR research will be to provide a comprehensive and versatile technical platform for the development of the next generation of indoor photovoltaic (IPV) systems that efficiently reuse energy from artificial lighting to power electronics taking into consideration growing concerns about sustainability. The consortium will cover all the key aspects and technologies related to IPVs, including sustainable design, organic and inorganic materials synthesis, photovoltaics manufacturing and characterization, device physics and modelling, theoretical and machine learning-driven approaches, photovoltaics recycling, and industrial processing.

Smart buildings represent a cutting-edge solution in this endeavour, harnessing digitalization and automation to coordinate, monitor, and regulate energy consumption in areas such as heating, lighting, and cooling. These systems rely on real-time data collected from an extensive and interconnected network of Internet-of-Things (IoT) sensors. However, a significant challenge lies in powering these IoT ecosystems. Currently, external power sources and batteries are required to fuel the IoT ecosystems, thus turning them into hard to maintain and environmentally hostile infrastructures. This results in high expenses, a significant carbon footprint, and limited IoT scalability. Therefore, creating cost-effective, sustainable, and energy-efficient solutions to fuel the rapidly growing volume of IoT sensors is of utmost importance.

The energy from the readily available light resource in buildings can potentially power the IoT nodes installed therein. This would create ***energy recycling potential*** to make IoT energy-autonomous thanks to the conversion of the artificial indoor lighting into electricity via indoor photovoltaics (IPVs). Low-cost, sustainable, yet efficient IPV technologies must be, however, developed to enable large-scale and low-energy footprint IoT deployments, and to sustain the enormous potential of IoT anytime and anywhere. To realize this opportunity sustainably, it is paramount to develop and employ ***low environmental-impact processing technologies*** for IPV devices that are ***compatible with industrial requirements*** and to ***adhere to the necessary standardized specifications*** becomes imperative. This is an area that will expand in parallel with the expansion of the IoT, which means new skills and expertise will be required by future technical leaders and relevant workforce.

Project tasks and objectives: The objectives of CINaM-CNRS doctoral student will 1) To reproduce high-efficiency organic IPVs using green solvents (e.g., o-xylene); 2) To transfer the technology from small-area devices to large area mini-modules (5x5 cm^2) on rigid and on flexible substrates by using doctor blading. Specific ink formulation will be developed using green solvents for the printing technique; 3) To transfer the module process from rigid to flexible substrates using air processing printing such as doctor blading; 4) To implement a printing process for large-area devices using green inks; 5) To develop a laser processing on rigid and flexible substrates to reduce device's dead area, ultimately increasing the efficiency of the solar cell.

Starting date: (January 1st, 2025) Negotiable.

Duration of the work contract: 36 months/full-time contract

Target degree: PhD degree from Aix-Marseille University, FRANCE. (https://ecole-doctorale-250.univ-amu.fr/)

Approximate gross salary: 3048.23 €/month (including mobility allowance).

Eligibility: Doctoral Candidate must be eligible to be enrolled into Doctoral Program at Aix-Marseille University, and have not been awarded a doctoral degree. The candidate must not have resided or carried out her/his main activity (studies, work, ...) in the country of her/his employer (for the present proposal Aix-Marseille University, FRANCE) for more than 12 months in the 3 years immediately prior to her/his recruitment.

The applicant must be in possession of Master of Science (MSc) diploma at the beginning of the employment.

English language requirements: Proficiency in written/spoken English is mandatory. In certain case, we may ask for a language certificate.

Closing date: 30.11.2024

The applicant must submit the following documents, only clear copy of the document will be considered.

- **Certified copies of the bachelor's and Master's degree certificates with the Diploma Supplement (DS)** as approved by the EU Commission for degree completed in European universities (when applicable). Official translations into English (if the original documents are in a language other than English).
- **Curriculum Vitae (CV)** (preferably in Europass format).
- **List of publications (if any)** with a description of the applicant's contribution to the publication.
- **References:** Letters or contact details of 2 or more referees included in the CV.
- **Motivation letters:** maximum 1 page where the candidate introduce himself/herself and present his/her qualifications, must be included his/her previous research fields and main research results. Candidate should emphasize his/her future professional goals.
- **Proof of residence:** Statement and certificates/documents proving his/her residence(s) in the last 4 years.

Please note that we will begin conducting interviews during the application period, so early complete applications are encouraged.