MARIE SKŁODOWSKA-CURIE POSTDOCTORAL FELLOWSHIPS 2023

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

NOVA Science School and Technology - LAQV-REQUIMTE

RESEARCH GROUP AND URL

Bio(chemical) Process Engineering - https://laqv.requimte.pt/research/research-groups/106-bio_chemical_process_engineering

SUPERVISOR (NAME AND E-MAIL)

Ana Almeida – ana.almeida@fct.unl.pt

SHORT CV OF THE SUPERVISOR

Ana Almeida is a researcher, contracted by Instituto de Biologia Experimental e Tecnológica (IBET) working in the SEArcularMINE European Project at Chemistry Department - NOVA School of Science & Technology (FCT-NOVA) since 07/2022 and responsible for the Laboratory for Advanced Manufacturing of Membranes. Full member LAQV@REQUIMTE, collaborator member at CENIMAT|i3N, member in 2 COST Actions (EUTOPIA – CA17139 and PhoBioS – CA21159), and Principal Investigator of the DynaCellCollect project (2022.01619.PTDC) financed by the FCT with 250k€. She has been involved in 13 national and international scientific projects in the area of processing and development of new materials.

She received the PhD degree in Materials Science and Engineering (10/2021), on “Cellulose Filaments for Responsive and Functional Materials” from the NOVA (Universidade NOVA de Lisboa). The research work developed was focused on isolation and characterization of cellulosic filaments and filament networks extracted from plants. In 2009 completed the MSc in Biotechnology and in 2007 the BSc in Applied Chemistry NOVA. She Worked at ITQB/IBET from 09/2008 until 09/2011. In 2012 she started working at CENIMAT until 06-2022. Since 07/2022, after obtaining a PhD degree, she has been working as a Junior Researcher at LAQV@REQUIMTE in the Bio(chemical) Process Engineering – Membrane Process Group.

She has published 1 book chapter (Elsevier); 15 peer-reviewed papers (8 in the last 5 years, 1 as corresponding author) in high IF journals, namely PNAS, Advanced Materials (highlighted on the inside front cover). Attended multiple scientific conferences, with 14 orals (5 invited) and 21 poster presentations. She was engaged in outreach activities such as European Researcher’s Night 2017 (demonstrator) and 2022 (responsible investigator), Encontro Ciência’20 (demonstrator), Exhibition @ National Museum of Natural History and Science – Lisbon (organizing member) and Liquid Crystal Art exhibition @ NOVA Library (organizing member). She was an organizing committee member of the GA meeting of the European project (2013), and of the 28th International Liquid Crystal Conference held in Lisbon, being responsible for the program (2018-2022). She is a founding and Board member of SPCL (Sociedade Portuguesa de Cristais Líquidos) and member of the International Liquid Crystal Society.

She supervised 2 BSc and 5 MSc thesis, and has 6 ongoing supervisions (2 BSc and 4 MSc) and also lectured theoretical and practical classes at FCT-NOVA, e.g., Polymer Physics and Chemistry. She was a member of 3 academic juries, 2 as a supervisor and 1 as main opponent. She is part of the Scientific Committee of 7 journals as reviewer and of 1 as Guest editor. In 2017 received the MoDeSt conference grant from the MoDeSt Society (It); 2019 the Luckhurst-Samulki Prize from the Journal of Liquid Crystals Editorial Board (UK); 2019 highest IF paper published in i3N during 2018-2019 and 2020 conference grant from the Advanced Materials & Liquid crystals Institute (USA).
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5 SELECTED PUBLICATIONS

- Almeida, A. P., Canejo, J., J., Mur, U., Čopar, S., Almeida, P. L., Žumer, S., & Godinho, M. H. (2019). Spotting plants' microfilament morphologies and nanostructures. Proceedings of the National Academy of Sciences, 116(27), 13188. doi:10.1073/pnas.1901118116
- Almeida, A. P. C.; Querciagrossa, L.; Silva, P. E. S.; Gonçalves, F.; Canejo, J. P., Almeida, P. L.; Godinho, M. H and Zannoni, C. (2019). Reversible water driven chirality inversion in cellulose-based helices isolated from Erodium awns. Soft Matter, 15(13), 2838-2847. doi:10.1039/C8SM02290A
- Almeida, A. P. C., Canejo, et al. (2018). Cellulose-Based Materials: Cellulose-Based Biomimetics and Their Applications. Advanced Materials, 30(19), 1870131. doi:10.1002/adma.201870131
- Almeida, A. P. C., Oliveira, J., Fernandes, S. N., Godinho, M. H., & Canejo, J. P. (2020). All-cellulose composite membranes for oil microdroplet collection. Cellulose, 27(8), 4665-4677. doi:10.1007/s10570-020-03077-x
- Ana PC Almeida, João P Canejo, Pedro L Almeida, Maria Helena Godinho (2019) Cholesteric-type cellulosic structures: from plants to applications. Liquid Crystals, 46 (13-14), 1937-1949. doi:10.1080/02678292.2019.1640904

PROJECT TITLE AND SHORT DESCRIPTION

CellDROP - Cellulosic Dynamic Responsive Membranes for Optimal Water Droplet Collection

CellDROP targets the manufacture and characterization of new hygromorphic cellulose-based meshes to efficiently collect water from air. The novel meshes are formed by micro/nano helical filaments that respond to environmental humidity. The ability to collect water results from high surface area to volume ratio and high porosity of the membrane. After water collection, the micro/nano filaments change shape promoting the water to flow easily by gravitation and to be stored. The water flow allows the filaments to re-shape and once again be available for collection of more water. Inspiration comes from humidity-responsive plant skeletons[1, 2], spider webs[3] and Namib Desert beetle's[4] ability to respond and capture water from air. Plants produce a large variety and amount of cellulose, forming meso and microstructures with unique characteristics and complex shapes. These structures are far beyond any current materials that can be artificially produced through technology. They are flexible, lightweight, low-cost, mostly destroyed and barely exploited. These organized structures in conjunction with liquid crystalline systems are great candidates to build-up hygromorphic water collection membranes. The evaporation of water is a ubiquitous phenomenon in the natural environment and a great source of clean energy. The energy associated with the evaporation of water from the ocean, watercourses or seaports is so subtle that is not given much attention to. This renewable source could supply enormous volumes of water. Every day, vast amounts of water evaporate powered by heat energy from the sun. Water driven movement of the CellDROP meshes could also be suitable for the assembly of an evaporation powered generator for production of clean energy[5].

CellDROP aims 1) to produce unique and complex responsive soft structures without the use of complicated lithography or precision machinery; 2) to give mechanical flexibility and stability to the system without the use of intricate deposition techniques and 3) to activate the system with no need of microelectronics or batteries. This nature-inspired approach to produce CellDROP meshes will involve specific material engineering strategies: i) to precise control the supporting flexible structure and directional movements of the cellulosic meshes; ii) chemical modification of cellulose skeleton in order to promote hydromorphic movement and consequent water collection; and iii) control the responsiveness of the anisotropic liquid crystalline elastomers used.

CellDROP meshes are suitable to be used in countries susceptible to the occurrence of regular drought episodes and that have access to ocean or water courses from which water is constantly lost due to evaporation. These membranes can also be used inside of closed greenhouses where most of water resulting from the evapotranspiration of plants may be recovered without the consumption of energy.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST*

Information Science and Engineering (ENG)

***Scientific Area where the project fits best** – Please select/indicate the scientific area according to the panel evaluation areas: Chemistry (CHE) • Social Sciences and Humanities (SOC) • Economic Sciences (ECO) • Information Science and Engineering (ENG) • Environment and Geosciences (ENV) • Life Sciences (LIF) • Mathematics (MAT) • Physics (PHY)