MARIE SKŁODOWSKA-CURIE INDIVIDUAL FELLOWSHIPS 2019

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

NOVA School of Science and Technology | LAQV – Associated Laboratory for Green Chemistry

RESEARCH GROUP AND URL

Laboratory of Membrane Processes
https://www.requimte.pt/laqv/research-groups/biochemical-process-engineering

SUPERVISOR (NAME AND E-MAIL)

Sylwin Pawlowski
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SHORT CV OF THE SUPERVISOR

Sylwin Pawlowski holds a PhD degree in Chemical and Biochemical Engineering from Universidade NOVA de Lisboa (2015). His PhD thesis was focused on “Experimental and Modelling Studies on Reverse Electrodialysis for Sustainable Power Generation”.

Since February 2011 he develops his investigation at Faculty of Sciences and Technology of the Universidade NOVA de Lisboa in the Laboratory of Membrane Processes at the LAQV-REQUIMTE. His research activities concern experimental, modelling and theoretical work in the field of membranes and electrochemical processes. His expertise includes computational fluid dynamics (CFD) simulations, multivariate statistical modelling, mass transfer phenomena, 2D fluorescence spectroscopy and electrochemical methods such as chronopotentiometry.

In 2013, at Institut Européen des Membranes, Montpellier (France), he worked on characterization of mass transfer phenomena in ion-exchange membrane-based processes. Between 2015 and 2016, he was visiting post-doc researcher in the group of Membrane Science & Technology at the University of Twente (The Netherlands) where, in a close collaboration with Wetsus (European Centre of Excellence for Sustainable Water Technology), he prepared and tested novel chevron profiled membranes. Currently he is involved in five projects. Since December 2016 he is scientific co-supervisor of a PhD student in the project entitled “Development of scale-up methodologies for pharmaceutical crystallization processes” developed at Hovione in the frame of business environment doctoral program in Refining, Petrochemical and Chemical Engineering (EngIQ). His second current activity is focused on computational fluid dynamics (CFD) modelling of fluid behaviour in monolithic porous columns, based on their virtual reconstruction from X-ray tomography data. The third project, in collaboration with The University of British Columbia (Vancouver, Canada), he is involved in the development of electrochemical shear stress sensors. He is also co-supervising a master student working at the development of lithium-selective membranes. Since April 2019 he is Research Associate in Reverse-Electrodialysis, at The University of Edinburgh, where he is responsible for the experimental characterisation of ion-exchange membranes and modelling of mass transfer by employing Maxwell-Stefan equations.

5 SELECTED PUBLICATIONS

- S. Pawlowski, N. Nayak, M. Meireles, S. Velizarov, J.G. Crespo, CFD modelling of flow patterns, tortuosity and residence time distribution in monolithic porous columns reconstructed from X-ray tomography data, Chem. Eng. J. 350 (2018) 757–766. [top 2% - Q1 - Engineering; top 5% - Q1 - Chemical Engineering; top 5% - Q1 - Environmental Science]

- S. Pawlowski, T. Rijnaarts, M. Saakes, K. Nijmeijer, J.G. Crespo, S. Velizarov, Improved fluid mixing and power density in reverse electrodialysis stacks with chevron-profiled membranes, J. Membr. Sci. 531 (2017) 111 - 121. [top 3% - Q1 - Chemical Engineering; top 4% - Q1 - Materials Science; top 4% - Q1 - Chemistry]

- S. Pawlowski, V. Geraldes, J.G. Crespo, S. Velizarov, Computational fluid dynamics (CFD) assisted analysis of profiled membranes performance in reverse electrodialysis, J. Membr. Sci. 502 (2016) 179 - 190. [top 3% - Q1 - Chemical Engineering; top 4% - Q1 - Materials Science; top 4% - Q1 - Chemistry]

- S. Pawlowski, C.F. Galinha, J.G. Crespo, S. Velizarov, 2D fluorescence spectroscopy for monitoring ion exchange membrane based technologies - reverse electrodialysis (RED), Water Res. 88 (2016) 184 - 198. [top 2% - Q1 - Environmental Science]

- S. Pawlowski, P. Sistat, J.G. Crespo, S. Velizarov, Mass transfer in reverse electrodialysis: Flow entrance effects and diffusion boundary layer thickness, J. Membr. Sci. 471 (2014) 72–83. [top 3% - Q1 – Chemical Engineering; top 4% - Q1 - Materials Science; top 4% - Q1 - Chemistry]

PROJECT TITLE AND SHORT DESCRIPTION

Continuous and sustainable recovery of lithium from seawater and brines by novel selective capacitive deionization.

Lithium is becoming an essential metal in global energy economy due to its applications in electric cars batteries; however, its recovery from land resources is geographically limited and not environmentally friendly. Although lithium can be extracted from seawater, the so far proposed processes are based on its cyclic/intermittent adsorption, showing a relatively low efficiency. To increase the lithium recovery degree from seawater and to make the process continuous, novel flow-electrodes (recirculated in a loop arrangement between cathode and anode) and highly selective membranes toward lithium transport will be developed and incorporated into a single flow-electrode capacitive deionization (FCDI) device. This new process will be developed and optimise through experimental investigation and advanced mathematical modelling. Systematic morphological, rheological, electrochemical and computational fluid dynamics (CFD) studies are envisaged. Long-term validation will be carried out to examine the system robustness and operational stability.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST

Chemistry (CHE) | Information Science and Engineering (ENG) | Environment and Geosciences (ENV)