MARIE SKŁODOWSKA-CURIE POSTDOCTORAL FELLOWSHIPS 2021

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

NOVA University Lisbon | School of Science and Technology

RESEARCH GROUP AND URL

CENIMAT/i3N
https://www.cenimat.fct.unl.pt/

SUPERVISOR (NAME AND E-MAIL)

Suman Nandy
s.nandy@fct.unl.pt

SHORT CV OF THE SUPERVISOR

Suman Nandy was awarded Ph.D in 2010 from Jadavpur University (India) in the area of materials science and nanotechnology. In March 2011, he has joined CENIMAT-i3N group as a Postdoctoral researcher under FCT-MCTES and successfully carried 6 years research programme. Currently, he is a senior researcher in Universidade Nova de Lisboa Departamento de Ciência dos Materiais. He has 13+ years of research experience in the field of Materials Science and Nanotechnology. During his research career, he came across a vast tome of scientific knowledge with a good understanding of materials processing, developments, and characterizations. Currently, he is supervising the research work based on “Green and Sustainable wearable energy system”. He is involved in several National and International projects. Recently he was attached with 1-D Neon project (Horizon 2020), for developing textile-based energy-harvester system. He is also supervising MSc and PhD students in the department of materials science. He has published several scientific papers and review article as an author, co-author, and corresponding author in very high-impact peer-reviewed journals with h-index of 16. He has presented research works in several national and international conferences. He is also part of several national scientific exhibitions like Ciencia Vive, EXPO, University Day etc. Areas of Investigation: Mechano-responsive energy harvester, Paper electronics, Polymer electronics, Wearable/Flexible electronics. He has a number of National and International collaborations including Co-LABs

Website for details:
https://www.snandy-research.com/
https://www.dcm.fct.unl.pt/pessoas/docentes/suman-nandy

5 SELECTED PUBLICATIONS

- Cellulose: A contribution for the zero e-waste challenge, S. Nandy*, S. Goswami, A. Marques, D. Gaspar, P. Grey, I. Cunha, D. Nunes, A. Pimentel, R. Igreja, P. Barquinha, L. Pereira, E. Fortunato, R. Martins, Review in ***Advanced Materials Technologies***, 2021, 2000994 (Hall of Fame Invitation and Selected as Hot Topic);

- Touch-interactive flexible sustainable energy harvester and self-powered smart card, G. Ferreira, S. Goswami, S. Nandy*, L. Pereira, R. Martins, E. Fortunato, ***Advanced Functional Materials***, 2020, 30(5), 1908994.

- Human-motion interactive energy harvester based on polyaniline functionalized textile fibers following metal/polymer mechano-responsive charge transfer mechanism, S. Goswami, A. dos Santos, S. Nandy*, R. Igreja, P. Barquinha, R. Martins, E. Fortunato, ***Nano Energy***, 60 2019, 794–801.

- Electro-Typing on a carbon-nanoparticles filled polymeric film using conducting atomic force microscopy, S. Goswami, S. Nandy*, A. N. Banerjee, A. Kiazadeh, G. R. Dillip, J. V. Pinto, S. W. Joo, R. Martins, E. Fortunato, ***Advanced Materials***, 2017, 29(47), 1703079.

**corresponding author*

PROJECT TITLE AND SHORT DESCRIPTION

Self-powered Sweat Sensor: Healthcare Monitoring Patch

The ability to monitor chemical elements in a continuous and periodic manner has become of general interest in many fields, especially in environmental sensing and healthcare monitoring. Analytical devices that can be used in body without harming any individual's status are key players as interfaces between vital chemical events and the digitalization of related observations. Today, these kind of sensing gadgets are actively proposed in different research group. There are several detection procedures, classified as colorimetric methods, enzymatic methods, surface-enhanced Raman spectroscopy (SERS), electrochemical and resistive methods, but most of them either need a power source or a big analytical instrument. Therefore, a self-powered assisted sensing patch is a demanding position.

Through this proposal, we are going to develop self-powered wearable health-care monitoring patch (STAMP) for continuous personal health observation using mechano-electrical energy generator (MEG) which converts waste energy of human motion into electrical signal. In the sensing MEG unit, local charge accumulation and Fermi level pinning in conjugated polymer (charge donating layer, CDL) due to application of pressure will lead to transfer of charge to the pressure delivering graphene electrode (charge collecting layer PDCCL) and hence development of voltage between them. The core idea behind this proposal is to, using human-interaction as a key point to produce differential electrical signal with and without the biomarkers. A selective passivation of the conjugated polymer layer (CDL) will be modified with specific enzymes or ionophores for different sweat biomarker (such as glucose, lactate, Na+, K+ etc.) and hence modulate the MEG signal via modifying the local charge accumulation. Thus, the human interactive output of STAMP can directly measure the sweat biomarker level and on the basis of which health status of the wearer can be monitored online. Very high signal strength (100-150 V or 1~2 W/cm2 under normal human movements through exercise or normal walking of ~ 0.1 N -1 kN forces and 1-6 Hz frequencies) and its large modulation (supported by primary results) are other key features of this proposed sensing concept. Detection level will be achieved through the prototyped point of care patch STAMP for different sweat biomarkers such as glucose: 0-300 □M, lactate: 0-30 mM, ethanol:0-30 mM, Na+: 0-40 mM, K+: 0-15 mM, Cl^-: 0-15 mM.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST*

Chemistry (CHE)
Information Science and Engineering (ENG)
Life Sciences (LIF)