



**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  
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**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.

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## PROJECT TITLE AND SHORT DESCRIPTION

In this digital era, world is facing off the challenges against rapid climate changes and continuous ecological disturbances, caused by the revolutionary growth in socio-economic developments with fastest growing trend in smart electronics, plastic-based products and the continuous dependence on non-recyclable raw materials. It is imperative that humanity finds new ways to revolutionize ecotechnology system while at the same time concurrently reducing the amount of waste products and continuous dependence on raw materials. This is a worldwide problem, including Portugal.

In that context, project will step in circular economy and minimum waste challenge, by designing a game-changing idea for better world. The proposed plan is constructing in such a way, that will buckle paper and electronic platform to bring a new smart paper-packaging technology which will have inbuilt self-powered tracking system. The principal idea behind the proposal is to develop touch-interactive power paper (TiPP) which will generate current under mechano-responsive charge transfer mechanism (MRCTM). TiPP will instantaneously generate electrical signal (target current and power densities: 30-40 mA m<sup>-2</sup> and 1-3 W m<sup>-2</sup> respectively) through an external physical interaction (either vibration, pressure or motion), that will be powered to the logistic control system and connected to the IoT. Tactile sensors built with a particular array of TiPP, will generate an exclusive signal which can be monitored through the wireless system. This self-powered tactile sensor technology will manage to build a self-powered security tracking (SST) Tag (target efficiency at least 80%) mostly for smart packaging industries. Motion tracking is a key area of sensor systems for security, transportation, and high-tech industry that intend to react in quick and secure situations like delays, attempted burglary, authentic goods etc. The traditional tactile sensors mostly working under piezoelectricity, capacitive, resistive or radio frequency mechanism, but that requires external power supply or particular reader to read the data. In some extreme and remote locations, recharging or replacing batteries of sensors is expensive, inconvenient, or even impossible.

This multidisciplinary project is great for the development of several technological skills since it involves several fields of science: chemical material synthetization, circuit designing and software programing.

## SCIENTIFIC AREA WHERE THE PROJECT FITS BEST\*

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