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Postdoctoral fellow position on stretchable Li-ion microbatteries for wearable microelectronics

Description: With the spectacular rise of wearable technologies, R&D on microbatteries is rapidly emerging on the world market. For example, smart electronic textiles require new features and battery designs that traditional battery technologies simply cannot provide. This has opened the door to innovation and added a new dimension to the global competition in battery research.¹ The potential sector that can be impacted includes Internet of Things (IoT), healthcare (skin patches, medical sensors, medical diagnostic devices), smart cards, etc. To date, the soft microbattery technology is still in its infancy because it requires the pooling of complementary knowledges in different scientific domains. Indeed, key competences in microelectronics, materials science, electrochemistry, polymer, and inorganic chemistry have to be gathered to overcome all technical challenges. This is a new hot topic with strong potential impacts in the future. Recently, we have reported a new concept for the development of stretchable Li-ion microbatteries.²⁻⁴ A prototype has been integrated in a scleral eye contact lens^{5,6} and several on-going projects involving big groups like SAMSUNG and THALES have been launched to fabricate functional and autonomous devices for IoT and medical applications.

The postdoctoral fellow will have to investigate new tracks to optimize the fabrication process and achieve the integration of the micropower sources for practical applications. Strong and recognized expertise in the field of batteries (electrode fabrication, assembling and testing) and materials sciences (characterization techniques) are required. Skills in microelectronics will be asset but is not requested.

Environment: The research activities of Flexible Electronics Department are dedicated to the development of technological bricks adapted to the achievement of flexible or/and stretchable electronic components for applications in smart electronics (human machine interface, IoT, smart sensing, bio robotic/mimetic... Fabrication of autonomous, thin, flexible and conformable devices spread the research from nanomaterials, energy harvesting and storage to heterogeneous integration on flexible/stretchable substrates. The project will take benefit of microfabrication and characterization facilities made available by the 660m² clean room and the technological platform "MicroPackS".

<https://www.mines-stetienne.fr/en/research/scientific-departments/flexible-electronics-department-fel/>

Application: send a short CV (max. 2 pages), the list of publications, and two recommendation letters to thierry.djenizian@emse.fr

Starting date: from September to December 2020

Duration: 12 to 30 months

Gross salary:

- 3080 €/month for less than 3 years of experience
- 3213 €/month for more than 3 years of experience

Recent articles published by the group:

1. M Nasreldin, S. de Mulatier, R. Delattre, M. Ramuz, T. Djenizian, Flexible and stretchable microbatteries for wearable technologies, **Advanced Materials Technologies**, accepted (2020).
2. T. Djenizian and R. Delattre, « Deformable accumulator», **International Patent** n° WO 2018/167393 A1, 20-sept-2018.
3. M. Nasreldin, R. Delattre, B. Marchiori, M. Ramuz, S. Maria, J. L. de Bougrenet de la Tocnaye, T. Djenizian, Microstructured electrodes supported on serpentine interconnects for stretchable electronics, **APL Materials.**, 7, 031507 (2019).
4. M Nasreldin, R. Delattre, C. Calmes, M. Ramuz, V. A. Sugiawati, S. Maria, J-L de Bougrenet de la Tocnaye, T. Djenizian, High Performance Stretchable Li-ion Microbattery, **Energy Storage Materials**, accepted (2020).
5. M Nasreldin, R. Delattre, M. Ramuz, C. Lahuec, T. Djenizian and J-L de Bougrenet de la Tocnaye, Flexible Micro-Battery for Powering Smart Contact Lens, **Sensors**, 19, 2062 (2019).
6. <https://www.science-et-vie.com/technos-et-futur/electronique-la-lentille-de-contact-augmentee-devient-autonome-49914>.