

## **Ph.D. position offer: Multi-physical Model of Lithium Battery including Aging based on Experimental Results**

### Keywords

lithium-ion battery, battery management system (BMS), battery module and pack, accelerated aging, remaining useful life, multi-physical modelling, digital twin

### Context

Batteries are among the main enablers for the use of renewable energies in transportation application. To use the available resources in the best manner their lifetime still has to be increased. This can be done using an adapted energy management system. For the development of a BMS digital twins bases on experimental results are required.

The Ph.D. position is part of the Horizon Europe project ENERGETICS. The phd thesis is funded for a duration of 36 months.

### Scientific Objectives

The focus of the Ph.D. thesis is on the development of a multi-physical model of a lithium battery, based on measurement results that have to be generated by the Ph.D. student in our laboratory:

- Review of the related state-of-the-art,
- Collection of existing approaches for accelerated ageing tests,
- Definition and conduction of accelerated ageing tests,
- Development of multi-physical model allowing to predict the battery behavior and aging in different conditions of battery life based on literature results and experimental results (digital twin),
- Cooperation in elaboration of battery management system and test on the digital twin,
- Contribution to experimental validation,
- Writing of the thesis document and defense.

The selected applicant will also be expected to:

- Publish in international journals and conferences,
- Participate in project meetings, in the writing of deliverables as well as in communication and dissemination events,
- Participate in the scientific activities of the respective laboratories and universities.

### Expected qualifications

- Master's or 5-year engineering degree in electrical engineering, renewable energies, or a related field,
- Interest for energy storage topics and research,
- Basic knowledge in electromobility and lithium-ion batteries,
- Experience with Python and/or Matlab programming,
- Good level of written and oral English,
- A good level of French is a plus.

### Supervision

The selected Ph.D. student will be supervised by:

- Dr. Daniela Chrenko, Associate Professor HDR at UBFC/UTBM and FEMTO-ST,
- Prof. Fei Gao, Professor at UBFC/UTBM and FEMTO-ST,

#### Application

Please send a motivation letter, a detailed CV and transcript of results to the following email addresses:

- [daniela.chrenko@utbm.fr](mailto:daniela.chrenko@utbm.fr)
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#### Additional Information

Location: FEMTO-ST at Belfort, France

Dates: october 2023 to september 2026

Financial support: Horizon Europe ENERGETICS

#### *About the ENERGETICS project*

ENERGETICS is a research project funded by Horizon Europe 2023 to 2026 including around ten partners from different European countries. It focuses on the design of a Battery Management System (BMS), that minimizes the battery ageing and thus increases the battery life time and saves resources. In the project one project partner focusses on the AI approaches and UBFC/FEMTO-ST focusses on a physical description of the phenomena as well as the battery testing in order to create a digital twin.

#### *About UBFC and FEMTO-ST*

Université Bourgogne Franche-Comté (UBFC) is a community of universities and institutions which gathers seven higher-education and research institutions. UBFC currently hosts more than 60,000 students and 8,800 staff. It spreads across 13 sites in the Bourgogne Franche-Comté region in France.

FEMTO-ST is a joint research unit of several UBFC institutions (Université de Franche-Comté, ENSMM, UTBM) and CNRS, the French national research center. With over 750 researchers and staff, it is a leading institute in the field of engineering sciences. Its Energy department is located in Belfort, France, and hosts the largest French research group in hydrogen energy. FEMTO-ST is a partner of FCLAB, a CNRS unit dedicated to applied hydrogen energy research and transfer. The SHARPAC team of the Energy department has a strong expertise in energy storage systems like hydrogen energy and battery systems, and especially in ageing-aware diagnostics and prognostics, and in energy and power management of systems integrating them.

FEMTO-ST also includes a multi-disciplinary humanities team, RECITS, with a focus on technological change.

For more information, see <https://www.ubfc.fr/> and <https://www.femto-st.fr/>.