

# ELECTROCHEMICAL ENERGY STORAGE

## INCL. BATTERIES FOR ENERGIE TRANSITION

The electrochemical energy storage (EES) market is booming. While lead batteries remain the major technology in terms of volume with 70% of the market in GWh, Li-ion batteries are growing strongly (annual growth rate of about 15 %) and now represent more than 50% of annual sales. This growth is driven by the electrified vehicle market (battery electric vehicle and plug-in hybrid electric vehicles) that is rapidly emerging around the world to limit greenhouse gas emissions and contribute to the energy transition. The uses and needs related to electrochemical storage push the development of solutions that present higher energy and power densities, containing less critical or strategic materials and improve service

life and safety. Unlike accumulators dedicated to consumer electronics applications, EES are based on serial and parallel combinations of many accumulators. These solutions must be sustainable and economically viable to have a positive impact on the climate. Complementary uses are also being given major attention at CEA Tech to cope with the strong emergence of intermittent electricity production (photovoltaic and wind power) that require massive energy storage. Two solutions are highly advanced to complement stationary batteries: the V2G (Vehicle to Grid) and the V2H (Vehicle to Home) whose main interests are to use the battery integrated in a vehicle as a temporary support to the grid.

### WHY A PHD RELATED TO ELECTROCHEMICAL ENERGY STORAGE AT CEA TECH?


CEA Tech, a major French research player in the energy transition, offers skills in the fields of electrochemistry, electronics, electrotechnic, thermal, mechanics together with safety management and ecodesign.

Around 200 researchers and technicians combines experimental work, carried out on dedicated platforms, with multi-scale and multi-physics modelling in order to understand in-depth controlling mechanisms and

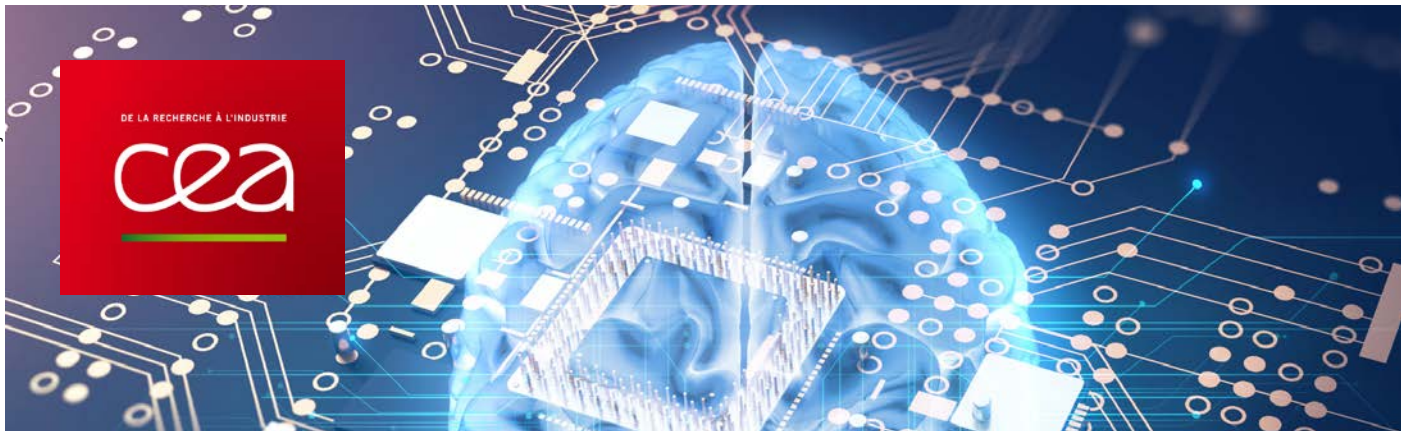
develop tomorrow's systems, such as solid Li-ion batteries, Na-ion or K-ion batteries, or high-energy supercapacitors. CEA Tech is partner or coordinator of numerous National, European and International projects involving industrial partners on electrochemical energy storage systems.

Completing a thesis at CEA Tech is a unique opportunity to contribute to the energy transition and to acquire skills on a current societal hot topic.



 CEA-Liten Institute in Grenoble Alpes

 40 ongoing PhD projects



# CEATECH SCIENTIFIC AND TECHNOLOGICAL CHALLENGES

CEA Tech tackles the three key and ongoing transitions of the 21st century: numeric, energy and medical ones. For each, CEA Tech research teams innovates within a vibrant network of academic and industrial partnerships, to develop the technologies of the future.

CEA Tech, one of the four CEA research divisions, relies on three large research Institutes, two in Grenoble, Leti and Liten and one in Saclay, List, and a network of technology transfer facilities in Bordeaux,

Nantes, Toulouse, Metz, Cadarache and Lille.

Close to 500 young researchers, prepare their PhD in CEA Tech Labs, with a major contribution to the research teams. They share the successes of the CEA, embodied in leading publications, patents, technology transfers to industry, business and start up creation. For years, Reuters ranks CEA as one of the top three most innovative research organizations in the world (1st, 2nd or 3rd).

## WHY A PHD AT CEA TECH?

Regardless of the field of research you are looking for, willing to explore prospective ideas or to further advanced technologie, you will likely find among CEA Tech doctoral positions the one that meets your expectations.

Then you can join either Leti (1800 p.) and focus on micro and nanotechnologies, embedded electronics, communications, components for the Internet of Things (IOT), cybersecurity, medical devices and healthcare outpatients (at Clinattec) - or Liten (950 p.) to face the challenges of non-CO2 emitting energies (solar, batteries, hy-

drogen, biomass or smart grids) - or List (750 p.) to innovate in terms of data intelligence, cybersecurity and IOT software, manufacturing (4.0 industries), radiotherapy, health data processing - or a research team located in one of the technology transfer facilities (Bordeaux, Nantes, Toulouse, Metz, Cadarache and Lille).

Whatever the topic you select, whatever the career path you envision, joining CEA Tech for your PhD has a deep meaning. On the one hand, you will be dealing with one major societal challenge, deeply rooted in science

and technology. On the other hand, your PhD will be at the heart of highly innovative ecosystems, each offering unique opportunities in research and career paths.

Indeed, CEA Tech offers a highly efficient mix of digital and hardware skills, world-class facilities such as state-of-the-art 300 mm clean rooms, and integration facilities for hydrogen and battery technologies, and many others. CEA Tech's teams form active partnerships with other research organizations and universities, as well as active cooperation with more than 500 industrial partners in France, Europe, North America and Asia.

We will do our best to accompany your success.



CEA-List Institute in Paris Saclay or CEA-Leti Institute in Grenoble Alpes or CEA-Liten Institute in Grenoble Alpes



500 ongoing PhD projects