

MOBICUS Project: Characterization and Modeling of Battery Ageing, with Application of Durability Strategies

The development of the market of electrified vehicles brings a response to environmental concerns, with sustainable mobility and the use of clean energy sources. The performances of electric energy storage system have improved with new generations of lithium-ion batteries, and their high energy density. Still, during the life of the vehicle, these batteries may undergo some degradation, with a capacity loss, and internal resistance increase through the effect of usage and time.

Car fleet owners, Car manufacturers want to ensure the profitability of their economic models, and cover the warranty costs, in case these batteries need to be replaced. Therefore, reliable battery ageing models, able to represent vehicle real usage scenarios are required.

The French National collaborative project MOBICUS (2013-2017) aims at designing and validating strategies enabling to improve battery durability with vehicle usage and recharge, from experimental measurements, models and validations.

Previous projects SIMSTOCK (2007-2011) and SIMCAL (2019-2012), focused respectively on cycling ageing and on calendar ageing at the cell level. The new approaches developed in MOBICUS bring:

- The non-linear strong coupling between calendar and cycling ageing
- The validation on extended domains of State of Charge and Temperature
- The application of dynamic thermal models
- Measurements on cells and packs

Various usage strategies have been tested on packs, thermal strategies have been evaluated, with applications to fast charging. State of Health diagnosis methods have been applied and compared with results of simulations based on vehicle history.

The battery ageing models can now be used for first and second life batteries, and be relevant for smart grids, and smart charging applications.