

3<sup>rd</sup> International Conference on

# Battery and Fuel Cell Technology

September 10-11, 2018 | London, UK

## MOBICUS project: Battery ageing testing, modelling, and strategies for improved durability

**Philippe Gyan**

Groupe RENAULT, France

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 (2009-2012), focused respectively on cycling ageing and on calendar ageing. 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 and; measurements on cells and packs. Various usage strategies have been tested on packs; thermal strategies have been evaluated, with applications to fast charging. The battery ageing models can now be used for first and second life batteries, and be relevant for smart grids, and smart charging applications.

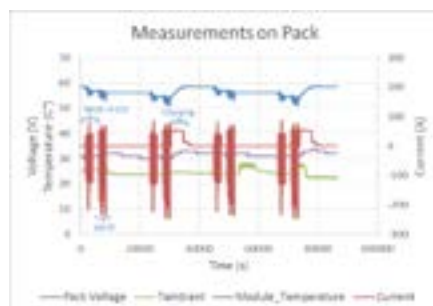


Figure 1: Pattern for ageing measurements on a battery pack.

### Recent Publications

1. P Gyan, P Aubret, F Sellier, S Bourlot, S Zinola and F (2013)Badin Experimental assessment of battery cycle life within the SIMSTOCK research program, Rev. IFP Energies Nouvelles DOI: 10.2516/ogst/2013106.
2. Baghdadi, O. Briat, A. Eddaech, J.M. Vinassa, P. Gyan (2015) Electro-thermal model of lithium-ion batteries for electrified vehicles applications. Industrial Electronics (ISIE), 2015 IEEE 24th International Symposium on.
3. Grolleau, Baghdadi, Gyan, Ben Marzouk, Duclaud (2016): Capacity fade of lithium-ion batteries upon mixed calendar/cycling aging protocol. EVS29 Montreal.
4. Baghdadi, R. Mathieu, O. Briat, J.M. Vinassa (2017) Lithium-Ion Battery Ageing Assessment Based on a Reduced Design of Experiments 2017 IEEE Vehicle Power and Propulsion Conference (VPPC).

### Biography

Philippe Gyan has graduated in 1998 from the Ecole Centrale de Lyon, with a PhD in Mechanical Engineering, Thermal and Energy Management. He has been working for the past 10 years in Renault Research Department for the Electric Vehicle Division. Through contributions to French National and European Projects, he has developed battery ageing models applied to real usage scenarios.

philippe.gyan@renault.com