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The 27th INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM & EXHIBITION
BARCELONA
17th-20th November 2013

Lithium-Ion Capacitor - Advanced Technology for Rechargeable Energy Storage Systems

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Supported by European Commission

Outline

- Introduction
- Lithium-ion capacitors
- Methodology
- Performances
- Model
- results
- Summary and conclusions

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Introduction

- Traction
  - Energy recovery/saving
  - Fast charging
  - Start-stop
  - Peak power absorption

- Renewable Energy & Grid Quality
  - Stabilization of electric power
  - Peak power absorption
  - Power quality improvement
  - Wind power generation
  - Photovoltaics

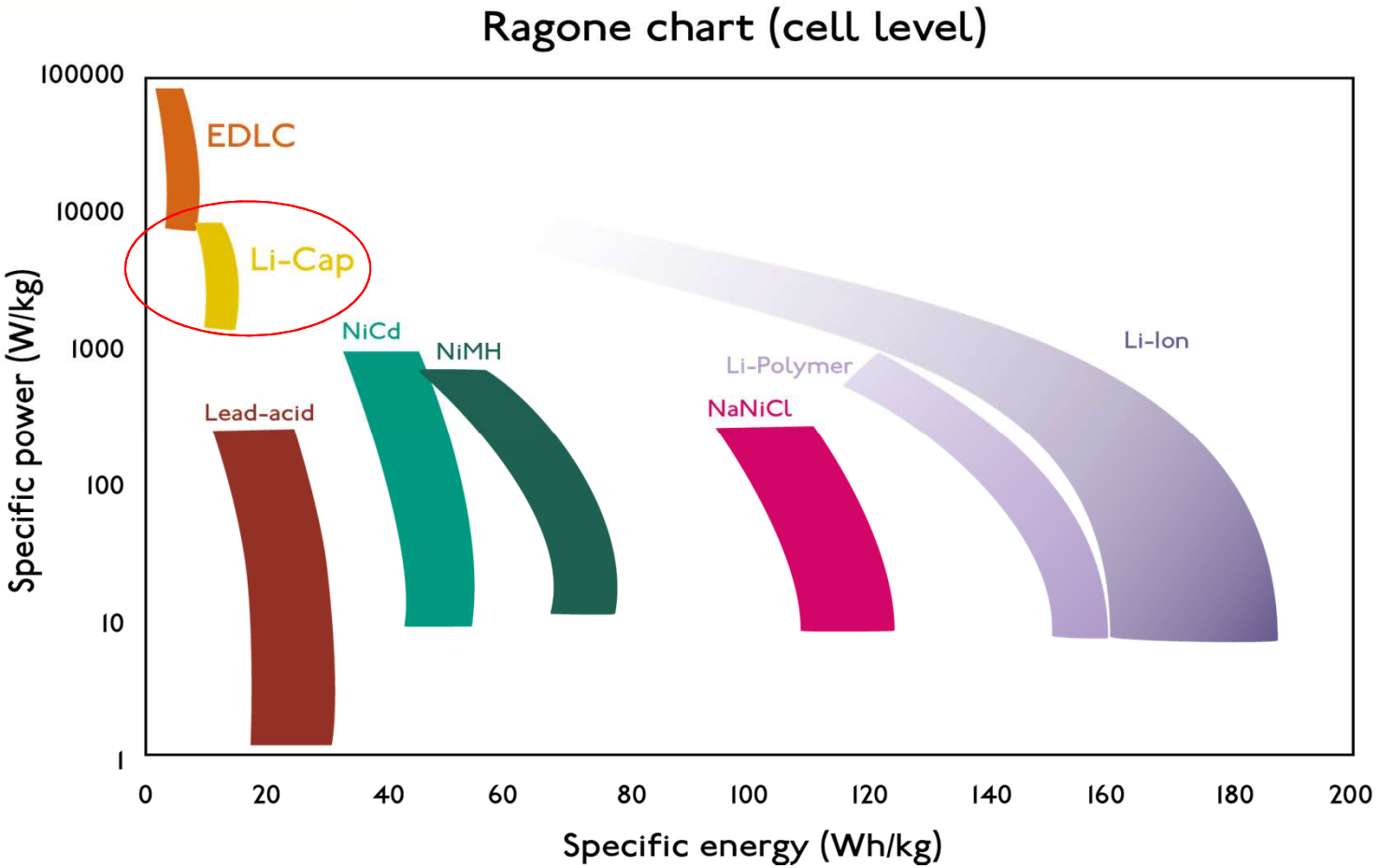
Introduction

- Energy regeneration
  - Forklift
  - Cranes
  - Construction machinery

RESS?

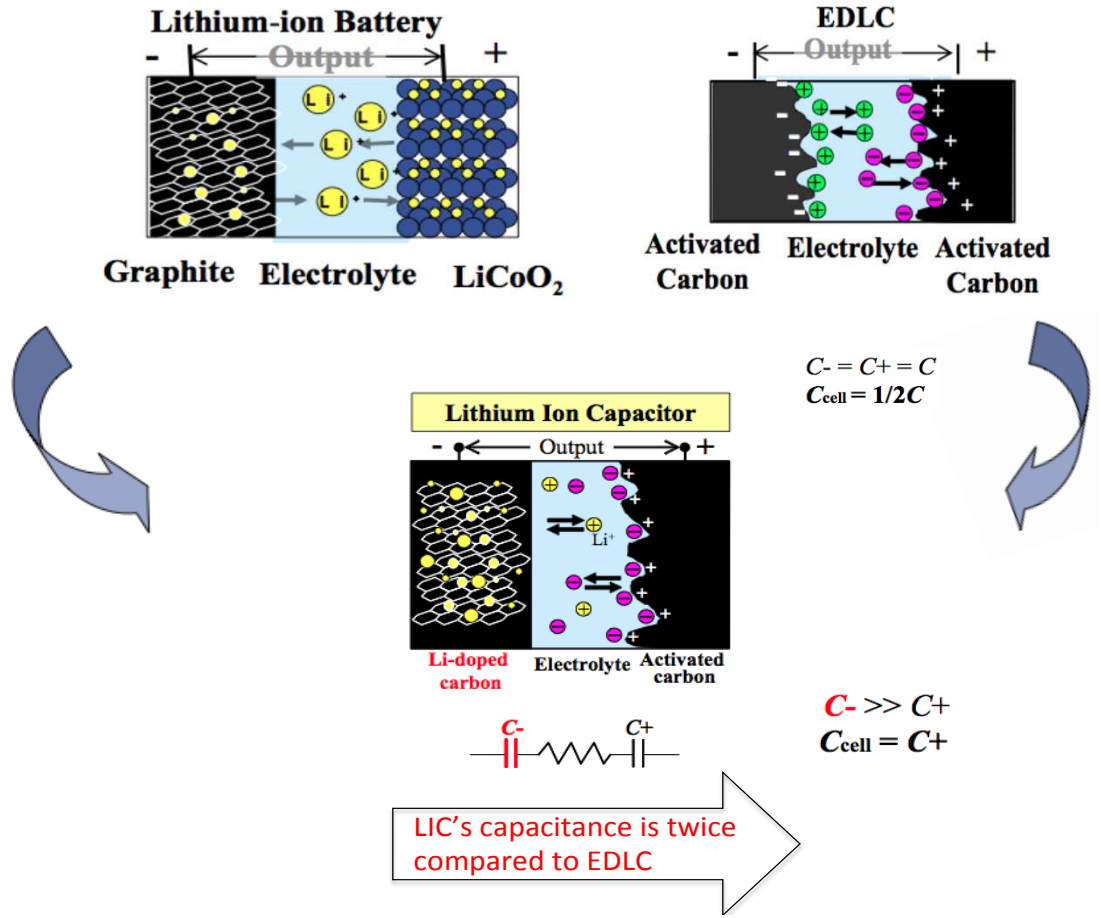
- Back-up
  - UPS
  - Telecommu… …r systems

RESS

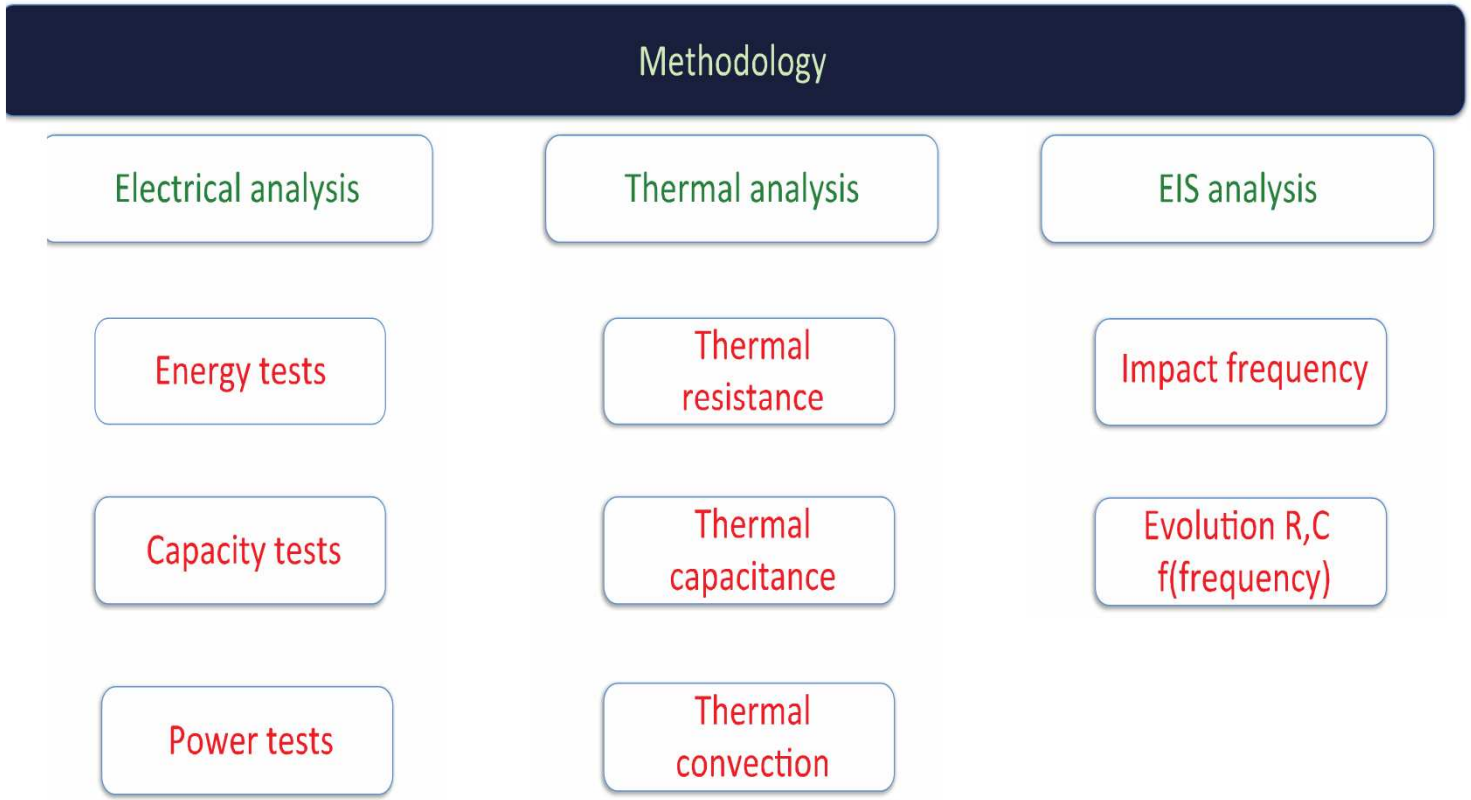

Ragone chart (cell level)
Specific power (W/kg)
100000
10000
1000
100
10
1
EDLC
Li-Cap
NiCd
NiMH
Lead-acid
Li-Polymer
NaNiCl
Li-Ion
0
20
40
60
80
100
120
140
160
180
200
Specific energy (Wh/kg)

Lithium-ion capacitors

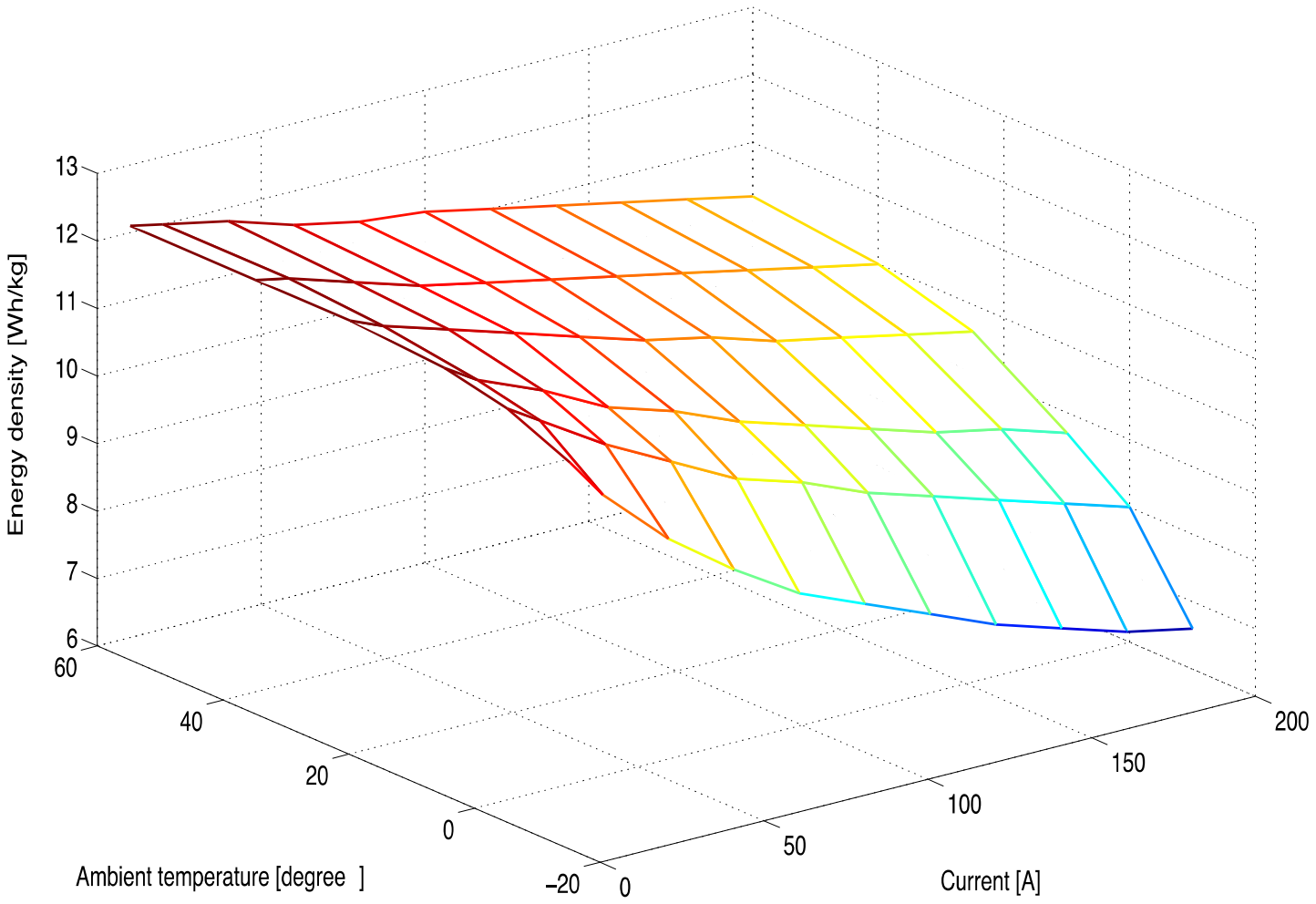
JM Energy



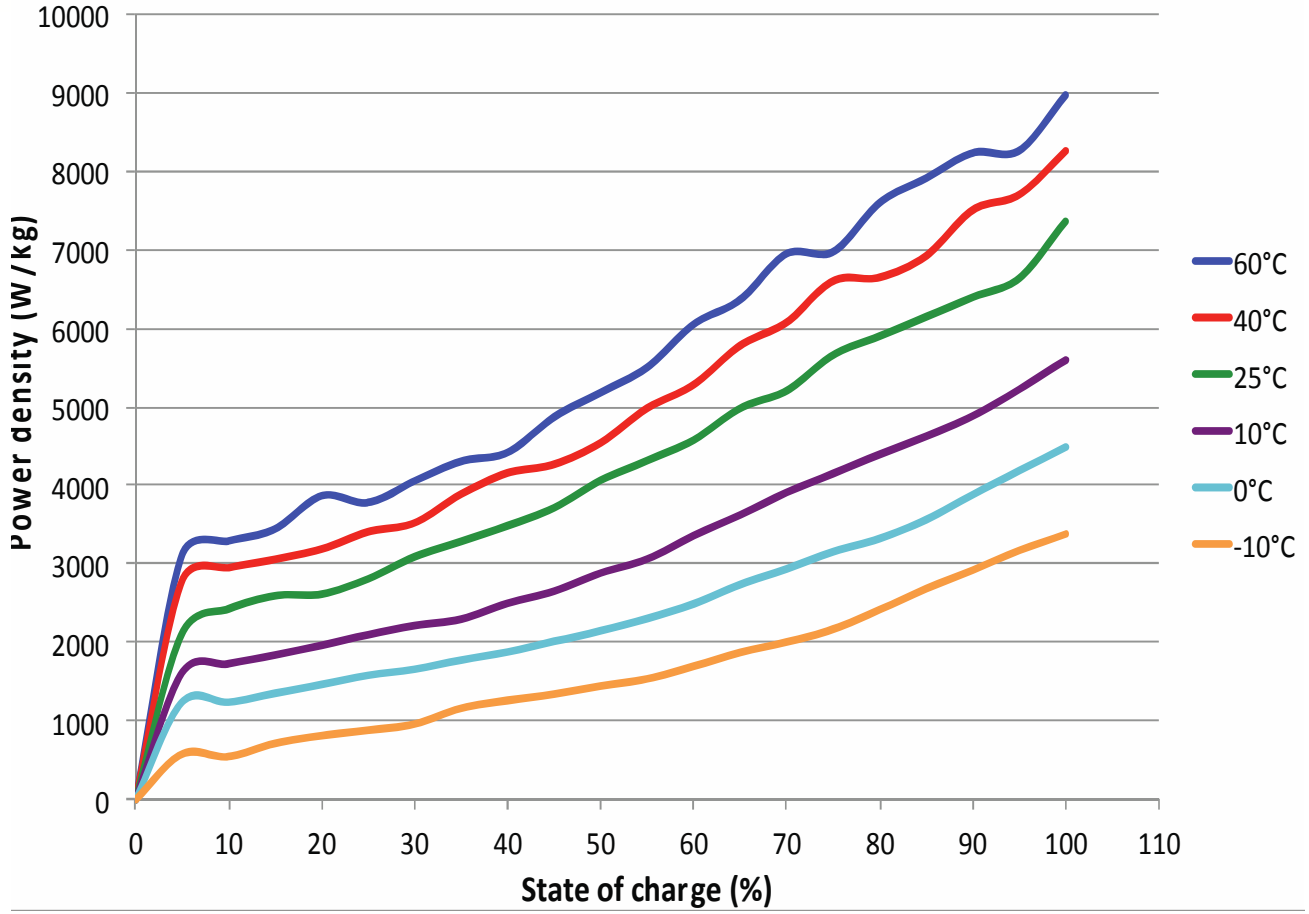
Methodology



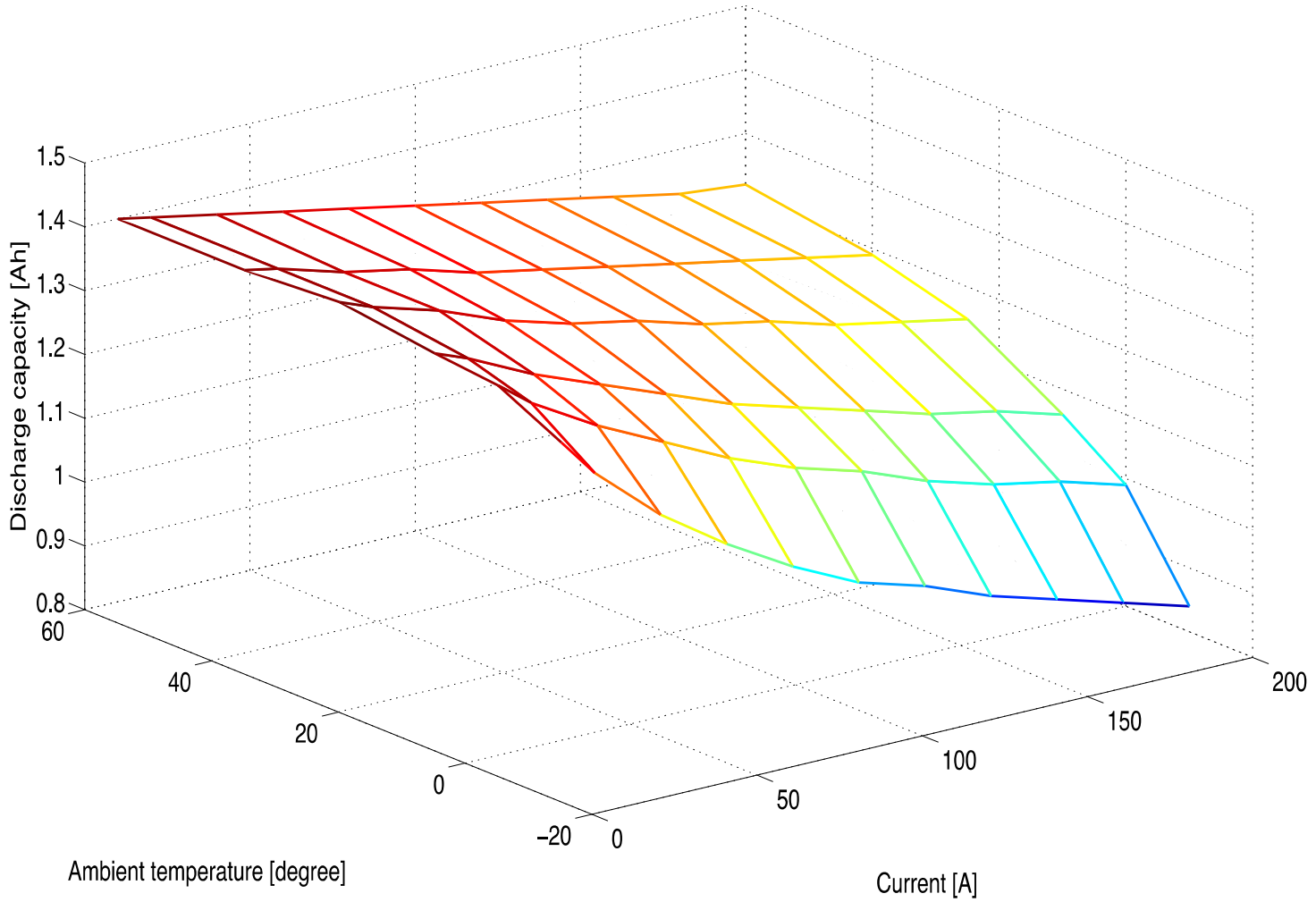
Energy evolution



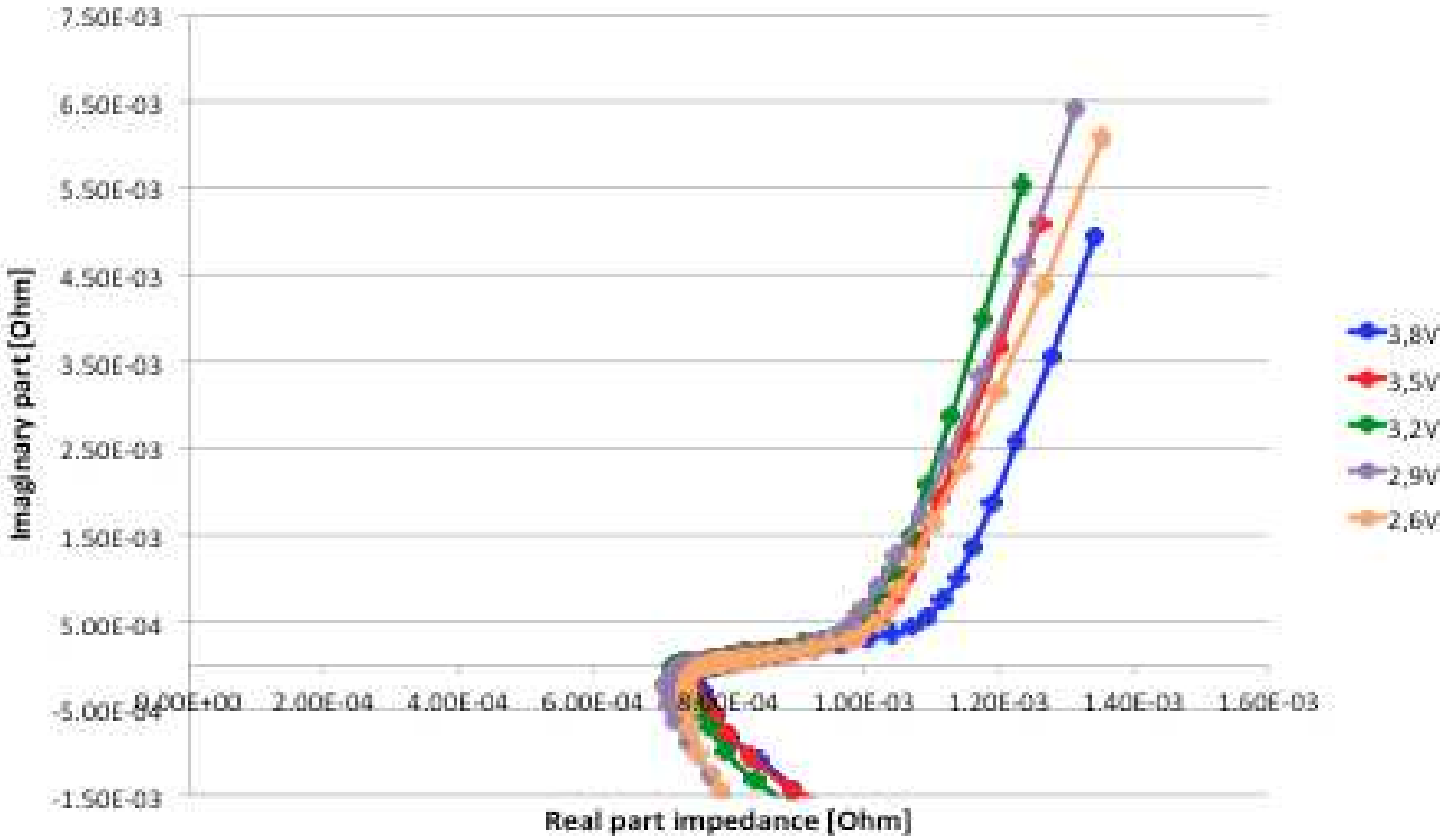
Power evolution



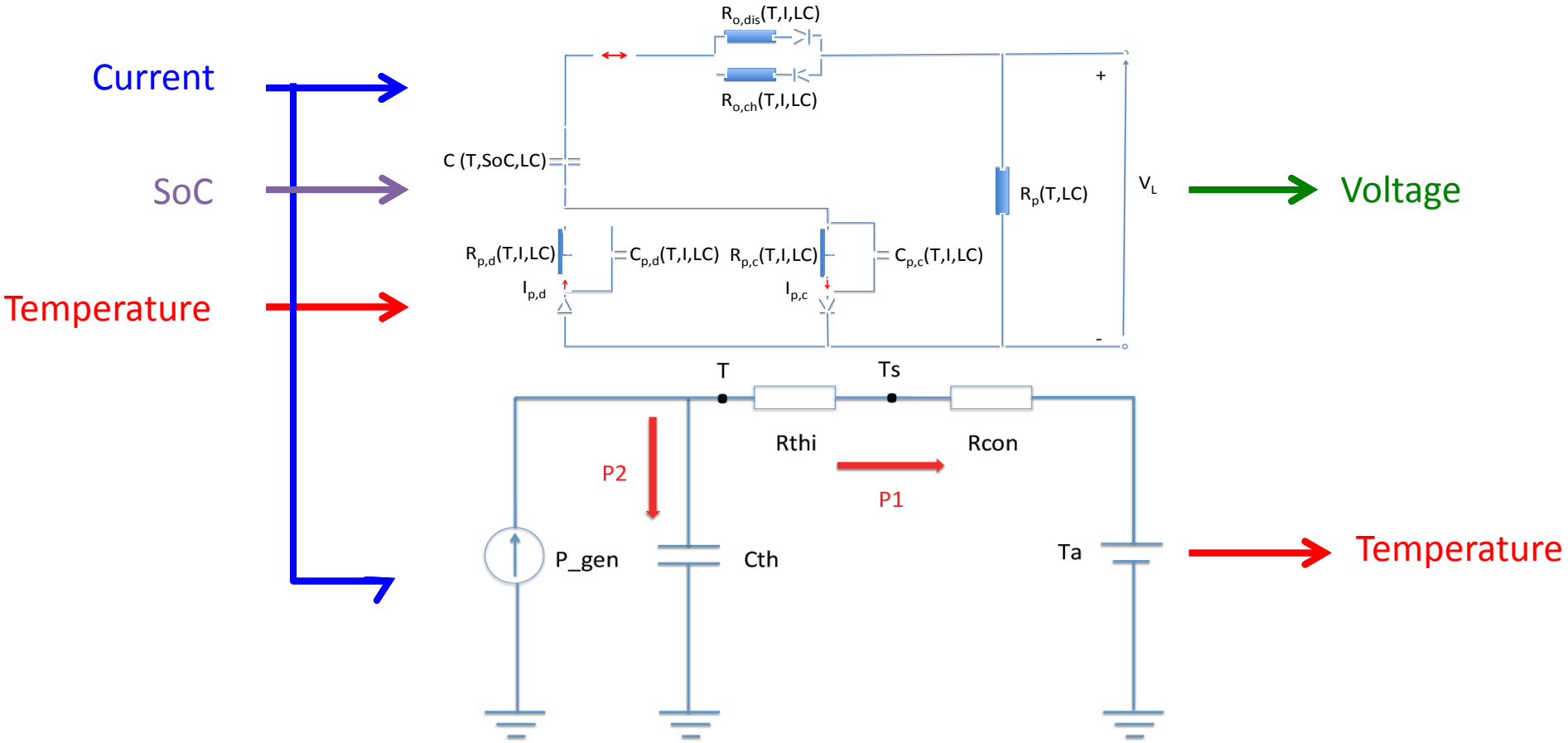
Discharge capacity



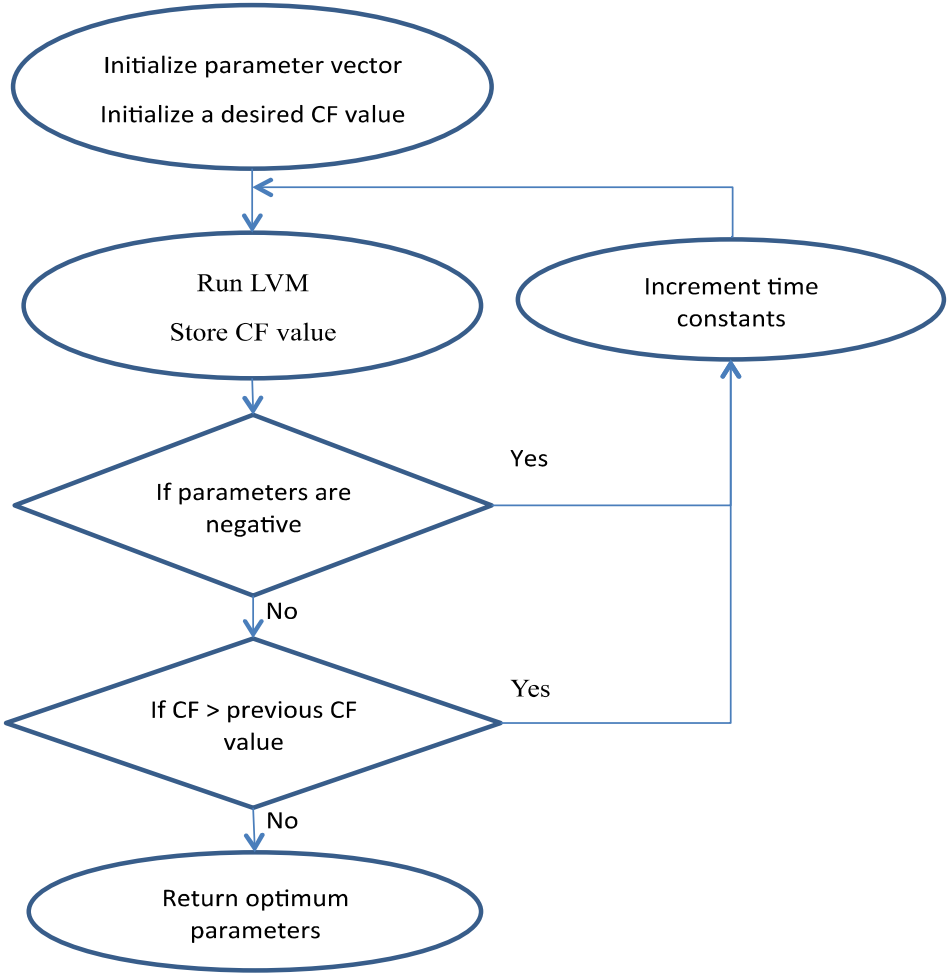
Electrochemical impedance spectroscopy



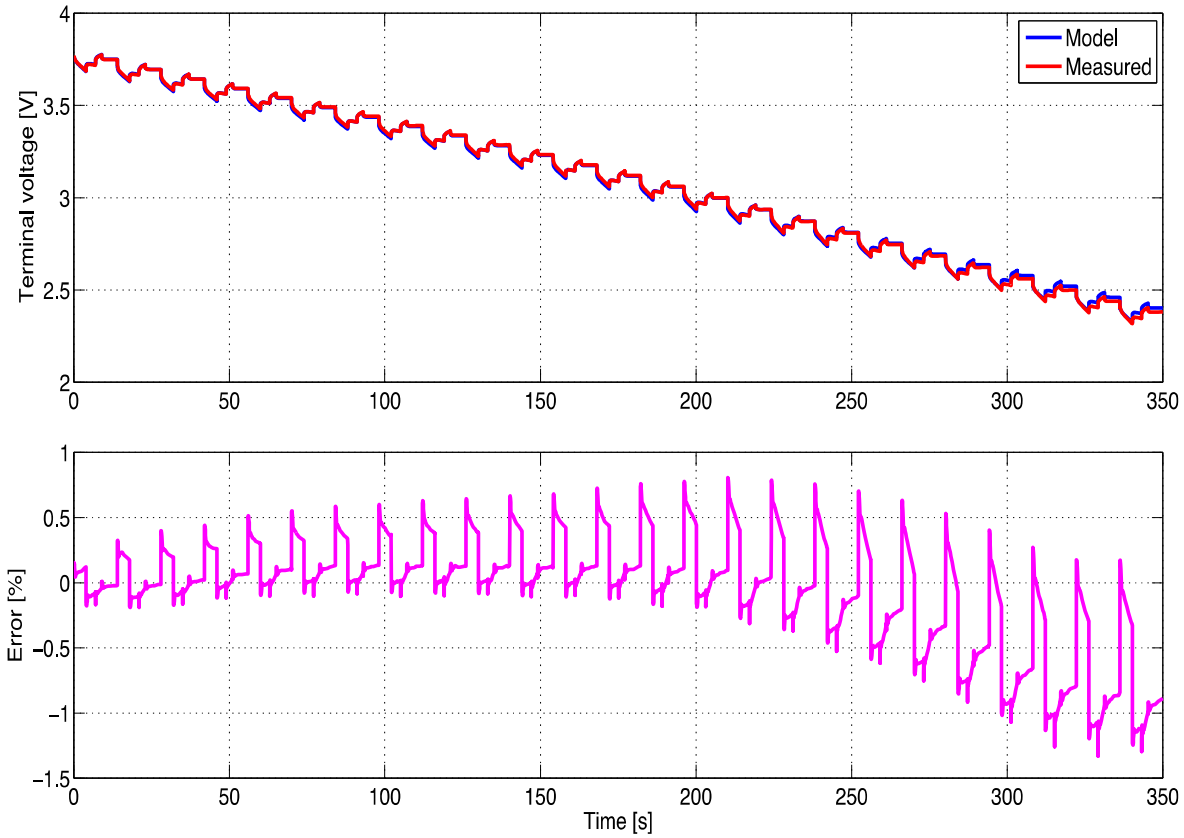
Model for LiCap



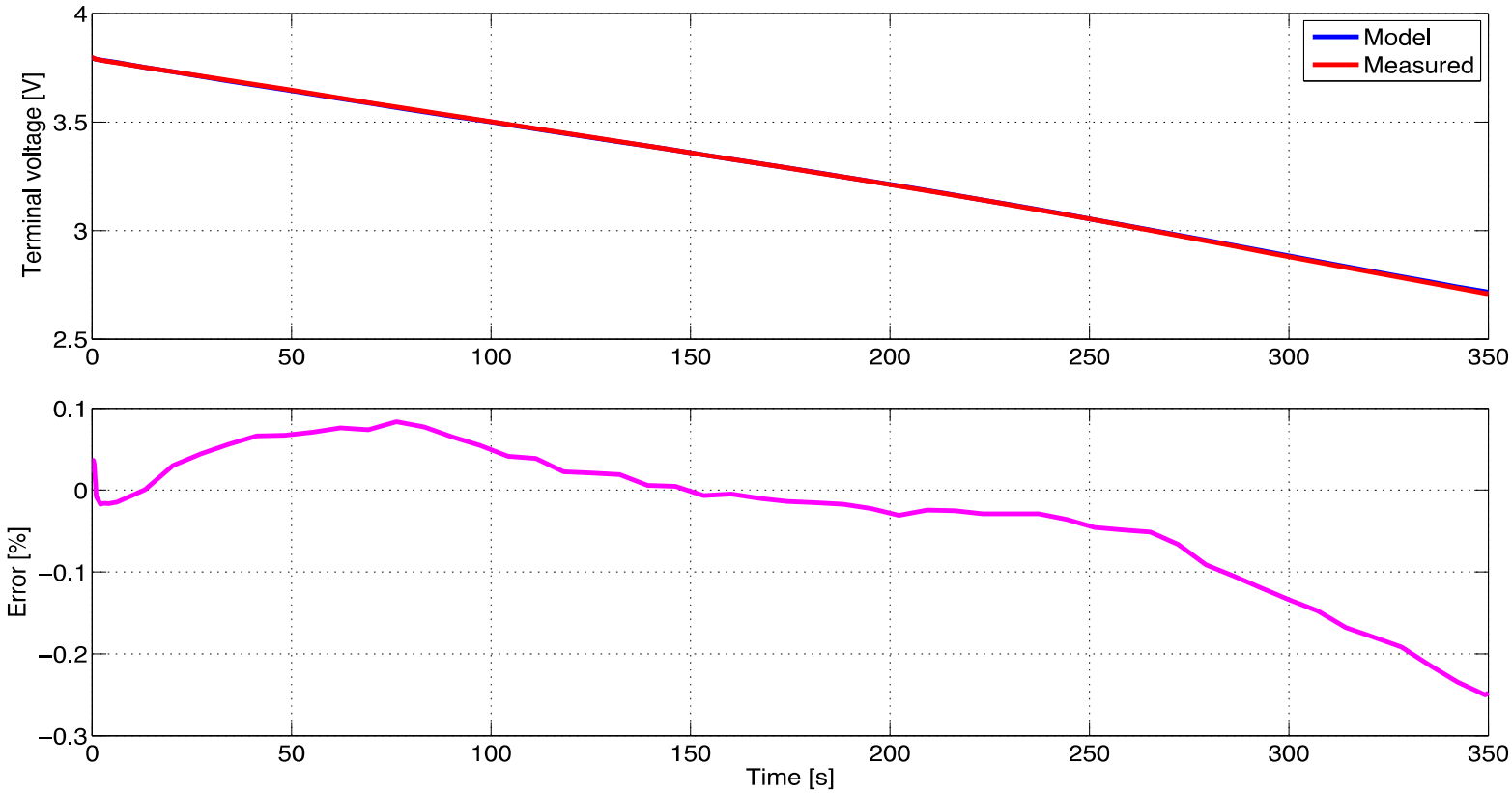
New estimation tool



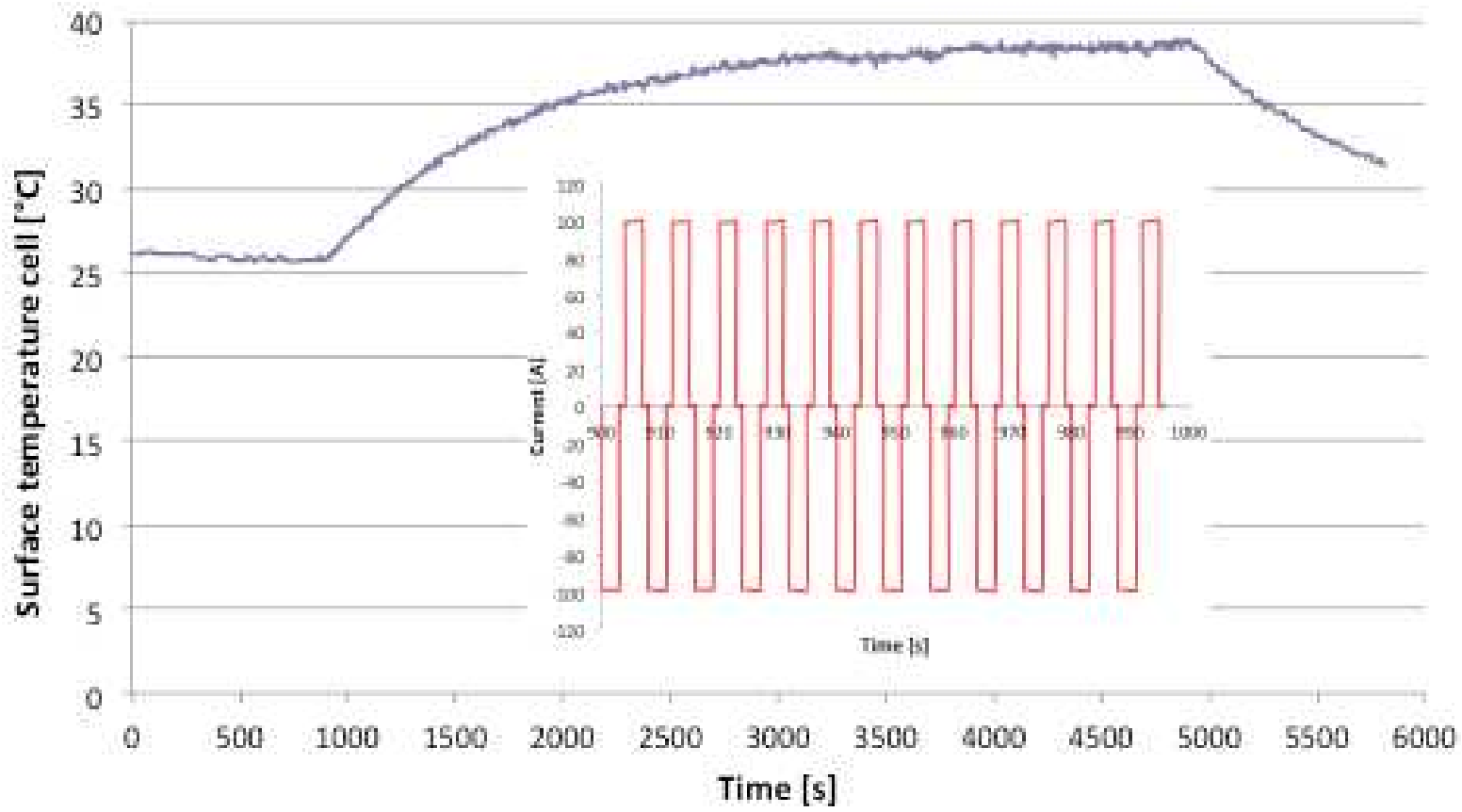
Simulation results



Simulation results



Thermal characteristics



Summary and conclusions

- Lithium-ion capacitor is an interesting technology
- Pre-doping of lithium is essential for increase of energy
- Extended analysis
- High power capabilities
- Energy density: 14 Wh/kg
- Long cycle
- New model

Future work

- Optimization of the LiCap system based on the developed model (interdisciplinary)
- Development op dedicated control strategies
- Assessment of performances
- Sizing of the LiCap system
- Various applications

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